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TROPICAL DISEASES BULLETIN

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BUREAU OF HYGIENE AND TROPICAL DISEASES

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SPONTANEOUS RUPTURE OF THE SPLEEN

by

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Ruptures of the spleen may be broadly classified as (a) traumatic and (b) non-traumatic or spontaneous. Strictly speaking there is probably some degree of trauma in almost every case of rupture, such as that due to lifting a heavy weight, vomiting or violent coughing, straining at stool or extreme restlessness. It is customary, however, to include in the category of spontaneous all cases in which there is no history of a blow or of crushing by some external force.

The literature relating to traumatic rupture of the spleen is extensive. The incident is of comparatively frequent occurrence in tropical and subtropical countries. In most cases there is gross enlargement of the spleen, usually as the result of repeated attacks of malaria. In a series of 123 cases collected by Berger,[71] 93 were classed as malarial.

Traumatic rupture of the spleen in malarious countries has often been a subject of medico-legal proceedings. McLeod [118] reported 7 cases of splenic

rupture occurring in Jessore, a highly malarious district in Bengal in the course of a year; 6 of these were among 33 bodies sent in by the police for post-mortem examination. Figures recorded by C. H. JAMES [106] from the Ambala district of the Punjab were remarkably similar, 6 cases being encountered in 35 police autopsies. CRAWFORD [86] collected records of 173 cases of ruptured spleen from 3,884 autopsies performed in Bengal, a percentage of 4·45. Only one of the subjects was a European, the remainder being indigenous people. In 4 cases in this and an earlier series of 304, rupture had been caused deliberately by pressure on the body as a means of murder. Crawford expressed surprise that so few splenic ruptures were brought about in this way, his impression being that this was a not uncommon means of removing an inconvenient person in that country, having the advantage from the murderer's point of view of leaving no external marks of injury.

Spontaneous rupture of the spleen has been recorded in a variety of conditions, the number listed by BURKITT [80] being no less than 29. The author concludes that this event may conceivably occur as an independent incident in a patient suffering from any complaint whatever.

However, as is the case with traumatic rupture, the great majority of spontaneous ruptures are associated with malaria. The next most common cause is said to be enteric fever.[221] BURKITT (*loc. cit.*) has drawn up a classification as follows:

A. *Apparently normal spleens*

(1) Without evidence of passive venous congestion
(2) With evidence of venous congestion, due to:
  (a) Diseases of the heart and lungs [64]
  (b) Diseases of the liver causing portal obstruction [208]
  (c) Pressure on portal circulation from without [12]
  (d) Portal thrombosis [1, 49]
  (e) Torsion of the splenic pedicle [22, 189]

B. *Pathological spleens*

(a) Malaria [80]
(b) Infectious mononucleosis [196, 205, 217, 218]
(c) Splenic abscess [80]
(d) Enteric fever [193, 195, 204]
(e) Acute general infections, such as relapsing fever [202]
(f) Haemangiomata [39]
(g) Chemical poisons (*e.g.*, nitrobenzene) [80]

In addition to the conditions specifically mentioned above, spontaneous rupture of the spleen has been recorded in kala azar,[104] acute epidemic hepatitis,[222] bacterial endocarditis,[203] leukaemia,[194] sarcoidosis,[199] erythroblastosis foetalis,[211] aneurysm of the splenic artery,[190] perforated gastric or duodenal ulcer [3, 186, 206, 219] and chronic alcoholism.[185]

SPONTANEOUS RUPTURE OF THE APPARENTLY NORMAL SPLEEN

Some 40 cases have appeared under this heading in the literature during the last 50 years. ZUCKERMAN and JACOBI [65] collected 27 and after exhaustive study accepted 20 of them as authentic, at the same time adding one of their own. BABSON and MORGAN [3] recorded 2 of their own and noted that 8 others had been reported since the publication of Zuckerman and Jacobi's paper. BRINES [11] collected 35, most of them already included in the 2 papers cited above, and added one of his own. MOORE and CHAPMAN [43] recorded 2 cases and NICOLL [45] one.

Spontaneous rupture of the normal spleen is a rare event, and several writers have expressed doubts as to whether it can ever occur in an organ which is really normal.[25, 34, 72] Bailey [5] has suggested that in cases of spontaneous rupture of apparently normal spleens there has been some minor splenic pathological condition and possibly an additional element of passive congestion. Harkins and Zabinski [27] remarked on the difficulty of excluding both minor degrees of trauma and the previous existence of arteriosclerotic changes or recent infarcts. Ask-Upmark [188] expressed the view that reflex spasm of the splenic vein may cause acute congestion and play a rôle in some non-malarial cases of splenic rupture. He believed that spontaneous rupture of the normal spleen is possible, explaining it on the basis of what he termed " a functional lienal apoplexy ". Weber [63] thought that rupture was in many cases due to a congenital anomaly of the spleen. He suggested that there may be a local vascular defect in the splenic vessels analogous to the congenital weak spots in the arteries of the circle of Willis at the base of the brain, which often give rise to small aneurysms or to subarachnoid haemorrhages; and that a similar rupture might occur in such congenitally defective splenic vessels.

There is obviously an element of trauma in some of the cases recorded as spontaneous. Three was them [9, 12, 35] occurred during pregnancy, where muscular contraction and increased abdominal pressure were no doubt contributing causes. One of these was that of a woman in her 16th pregnancy whose spleen ruptured as she stretched backwards and upwards to turn out the electric light. Splenectomy was performed and the infant delivered by Caesarean section. Eighteen months later she gave birth to her 17th child.

Muscular action was also the immediate cause in a case reported by Susman,[59] where the incident occurred as the patient bent down to lift a bucket of water, and in that of Rankin,[48] where the patient was straining to pull a cable over a pulley to raise a heavy weight. Stretton [58] recorded one in which rupture of an apparently normal spleen in a woman was attributed to excessive violence in coitus. Three other cases have been reported where an abnormally long pedicle probably caused congestion leading to rupture as the result of torsion.[22, 189]

There remains, however, a proportion of cases in which there is no evidence whatever of trauma, and where no pathological changes of any description can be detected in the spleen. In one such case the incident apparently occurred during sleep, the patient being awakened by sudden abdominal pain.[62] Again, Metcalfe and Fletcher [42] reported 2, both in men 21 years of age, in neither of which was there any history of trauma or of malaria or any other likely cause. In both instances the spleen was apparently normal macroscopically and microscopically. A number of similar cases are on record.

Spontaneous rupture of the malarial spleen

Non-traumatic rupture of the chronically enlarged malarial spleen is exceedingly rare, if indeed it ever actually occurs. The following alleged instances have been recorded, but in no case can the element of trauma be definitely excluded:

(i) French [98] described a prisoner who, while under treatment for diarrhoea, died suddenly. At the autopsy a tear was found in the inner surface of the spleen, which weighed 29½ ounces.

(ii) C. H. James [106] recorded that an Indian lawyer, while examining a witness in court, suddenly became faint, fell to the ground and expired

within a few minutes. At autopsy the ruptured spleen was found to weigh 3 lb. 13 oz.

(iii) CRAWFORD [86] reported a prisoner aged 75, who was suddenly seized with pain in the abdomen and began tossing violently in bed. He died 1½ hours later. The spleen measured 11 by 3 inches and there was a rent in the capsule 4 inches long. Three cases of apparently spontaneous rupture of chronically enlarged malarial spleens in natives of India were also recorded by GIBBONS.[99]

(iv) CIMBALLI [83] recorded a man aged 65, who on getting out of bed one morning experienced a sudden severe pain in the left side, collapsed and died. At the autopsy a rent 3 to 4 cm. long was found at the upper pole of an enormously enlarged spleen.

(v) In a report by the Chief Medical Officer of Langson, Cochin-China,[68] the case is recorded of a European who had been 17 years in that country and was suffering from malarial cachexia. He had a sudden rise of temperature with violent dyspnoea and died within 1½ hours. At the autopsy an extensive subcapsular rent was found in the spleen, which weighed 590 gm.

Spontaneous rupture of the spleen is an event which occurs typically in *acute* malaria, *usually in the primary attack*. The complication is more common in therapeutic malaria than in naturally acquired malaria, as is to be expected, having regard, in therapeutic malaria, to the age of the patients treated, the entire lack of immunity, the likelihood of other pathological changes, the fact that the patient is often restless and may be violent, and the withholding of specific treatment until a number of febrile paroxysms have been experienced.

Several authors who have reported cases of spontaneous rupture of the malarial spleen during the past 35 years have collected the records of others from the literature and have included them in their papers. INGRAM,[31] reporting a case of splenic rupture in a West African negro, cited 36 references, mainly to English literature. LEIGHTON,[112] reporting a case which came under his own observation, collected records of 72 others, dating from 1842 onwards. His paper was published before the general adoption of malaria as a therapeutic measure for neurosyphilis. HERSHEY and LUBITZ [104] reported a case of their own and collected records of 64 others which had occurred during the period following the publication of Leighton's paper. Of these 25 were in naturally acquired and 39 in induced malaria. KAPLAN *et al.*[169] and BEST and SCHMID [72] also collected records of a number of cases of spontaneous rupture of the malarial spleen, but most of these were included by Hershey and Lubitz. The paper by the last-named authors has been found particularly useful in compiling this review.

Spontaneous rupture of the spleen in naturally acquired malaria

In addition to the 73 cases of splenic rupture in naturally acquired malaria reviewed by Leighton and the 26 cited by Hershey and Lubitz, articles referring to about 40 others have appeared in the literature; 21 of these occurred among military personnel, 4 during or shortly after the first world war, and the remainder during the second world war or during the operations in Korea. It is highly probable that there were other cases which went unrecognized or unrecorded during the first world war, when the incidence of malaria was excessively heavy on certain fronts, especially in Macedonia and in East Africa. In Macedonia there were 160,517 admissions to hospital for malaria during the years 1916 to 1918, and in East Africa there were in 1917 alone 72,141 admissions out of a total strength of 50,782, a ratio of 1,422 per 1,000 per annum.

The frequency of spontaneous rupture of the spleen in naturally acquired malaria is difficult to assess. In the Panama Canal Zone during the construction period it occurred 3 times in 30,000 hospital admissions [125] and was found in 3 out of 100 autopsies performed on patients dying from *Plasmodium falciparum* malaria.[110] In more than one paper the statement has appeared that spontaneous rupture of the spleen is responsible for 4·45 per cent. of all malaria deaths in one section of India. This figure is evidently based on data presented by CRAWFORD [86] and referred to earlier in this review. It represents the percentage of cases of ruptures of the spleen found at autopsies carried out in Bengal, the great majority of which (399 out of 477) were certainly traumatic in origin, the cause of the remaining 78 being unknown. Needless to say, such figures are completely valueless as a means of estimating the incidence of *spontaneous* rupture of the spleen in malaria. HARRIS [162] quotes MANSON-BAHR as saying that this complication occurs in only 1 in 100,000 cases, and POLAYES and LEDERER [175] give an approximate figure of 1 in 50,000, but in neither paper is there any mention of the data on which the estimates were based.

Spontaneous rupture of the spleen in induced malaria

The 39 cases in this category cited by Hershey and Lubitz included one from the Central State Hospital, Indianapolis.[147] Two others have since occurred in this institution [149a] and one each has been reported by MOSES [173] and by CORTESI.[154] During the past 30 years there have been 7 among patients treated for neurosyphilis at Horton Hospital, Epsom,[166] and one in a patient treated at a mental hospital in Liverpool,[143] bringing the total number of reported cases to 51.

As regards frequency of incidence, the 3 Indianapolis cases occurred among 1,000 patients treated and the 7 Horton cases were from a series of 2,622. The Liverpool case was the only one recorded out of some hundreds treated with material supplied from the Liverpool School of Medicine during the past 30 years. WAGNER-JAUREGG, in a letter written in July 1925, stated that out of 1,200 patients treated with induced malaria by himself and his assistants since 1919 no case of ruptured spleen had been encountered.[182] However, as noted above, the incidence of spontaneous rupture of the spleen is without doubt very considerably higher in induced malaria than in the naturally acquired disease. Data illustrating the frequency of this complication in induced malaria are given below:

Authority	Total cases	Splenic ruptures	Percentage
DECARY [158]	274	2	0·7
DE ASIS [157]	101	2	2·0
WILE AND MUNDT [184]	1,026	1	0·1
MOORE [172]	1,600	2	0·13
FONG [161]	1,012	2	0·2
DRIVER *et al.*[159]	2,479	0	0·0
CANTACUZÈNE [151]	525	1	0·2
DATTNER [156]	5,000*	0	0·0
HORTON Hospital [166]	2,622	7	0·26
BREUTSCH [149a]	1,000	3	0·3
WAGNER-JAUREGG [182]	1,200	0	0·0
Total	16,839	20	0·12

* These patients were not allowed more than 8 febrile paroxysms.

Kaplan *et al.*[169] estimated that the incidence of splenic rupture in induced malaria would probably be twice as frequent as the figures suggest if non-reported cases and those not recognized could have been included.

Several writers have studied the pathology of the syphilitic spleen in an attempt to explain the higher incidence of rupture in induced malaria. Hencke and Lubarsch [163] suggested that this was due to an increased friability of the blood vessels in general paralysis. Bigland *et al.*[149] and Rudolf [178] noted an increased amount of fibrous tissue in syphilitic spleens, the latter author concluding that rupture would be less likely on that account. Polayes and Lederer,[175] on the other hand, argued that the loss of elasticity which must accompany a fibrotic process would tend to increase susceptibility to rupture. It seems probable that the higher incidence is brought about by a combination of the facts mentioned above, namely vascular changes associated with syphilis and advancing years, the withholding of specific antimalarial treatment, and the tendency in general paralysis to extreme restlessness and sometimes to maniacal violence.

Species of parasite

Spontaneous rupture of the spleen has been reported more frequently in *P. vivax* malaria than in other forms of the disease. This species of parasite was found in 16 of the 19 cases collected by Hershey and Lubitz in which the species was stated. Spontaneous rupture in *P. falciparum* malaria has been reported by Davidson [88] (1 case), Noland and Watson [125] (3 cases), Dorolle and Dan Huu Chi [92] (1 case), de Saram and Townsend [90] (1 case), and Kean and Smith [110] (3 cases). Six were recorded during the second world war in East Africa,[95] where *P. falciparum* is by far the most prevalent parasite. Quartan cases have been reported by Messerer [123] and Moses.[173] One of the Horton series was also infected with *P. malariae*.[166] Hershey and Lubitz [104] state that in one of the cases collected by them *P. ovale* was found. The preponderance of *P. vivax* among the induced malaria series is probably due to the fact that this is the parasite most frequently used for malaria therapy.

Pathological changes encountered in spontaneous rupture of the malarial spleen

The splenic pathology in most cases differs little from that typically met with in acute malaria. There is almost invariably gross enlargement of the organ, which is commonly 3 or 4 times the normal weight. The capsule is usually stripped from part of the surface as the result of subcapsular haemorrhage and in some instances only that portion covering the hilum remains *in situ*. Occasionally adhesions are present between the spleen and diaphragm and it has been suggested that these may contribute to rupture by limiting expansion. Tears may be found on any of the spleen's surfaces and these are frequently multiple. The pulp is always excessively friable and in examining a spleen which has been removed post mortem or by operation it is often difficult to determine whether a tear or tears have occurred spontaneously or have been produced by manipulation. This was the case in a spleen recently removed from a patient in Horton Hospital, where the only clue was the presence of blood clot in two of the tears.

In some cases the spleen has been found to have burst into fragments, which are loosely held together by blood clot.[104] Vascular changes have been described; foci of interstitial haemorrhage are frequently seen and occasionally thromboses and infarcts are observed. Subcapsular haematomata may be present.

Mechanism of rupture

The probable course of events in most cases of spontaneous splenic rupture is: (i) the presence within the spleen of local vascular lesions; (ii) increase of tension due to hyperplasia and engorgement; (iii) interstitial haemorrhage from rupture of a damaged vessel; (iv) secondary haemorrhage causing a subcapsular haematoma; (v) rupture of the capsule.

Owing to the disruption brought about in the process of rupture, it is often impossible to identify the exact site of initial haemorrhage, or even of initial rupture of the capsule. The most constant aetiological factor is probably the general increase of tension brought about by rapid enlargement, and it is because malaria is the most frequent cause of splenic hyperplasia that spontaneous rupture occurs more often in this disease than in any other.

As noted earlier, the immediate precipitating cause may be any factor which produces an increase in abdominal pressure, such as excessive coughing, vomiting, straining at stool or uterine contraction in labour.

Time of rupture

In the series reviewed by Hershey and Lubitz,[104] rupture occurred as early as 2 days after the onset of symptoms, while in one-third of the cases it happened later than the 13th day. Of the 7 patients recorded at Horton, none had had more than 8 febrile paroxysms, one had had 4 and one only 3. It is, however, noteworthy that no case of rupture apparently occurred among 5,000 patients with induced malaria referred to by Dattner,[156] in all of which the course of the disease was interrupted after not more than 8 paroxysms. A case recorded by Schrum *et al.*[136] is of interest. A 20-year-old soldier, admitted to hospital with a history of 4 days' fever, received routine treatment with chloroquine and became asymptomatic after 36 hours. He was to have been discharged on completion of 5 days in hospital, but on the day before the proposed discharge he was seized with nausea and diarrhoea and later collapsed. A laparotomy was performed at which the peritoneal cavity was found to be filled with blood and the spleen moderately enlarged with a subcapsular haematoma. The organ was removed and the patient recovered without further incident.

Clinical features

These are largely determined by the rapidity with which the events above described take place. In the series of patients with induced malaria reviewed by Hershey and Lubitz, half died with no complaint of pain at any time, presumably because of extreme shock with early collapse. Absence of pain and paucity of physical signs account for the fact that none of the induced cases was correctly diagnosed. Three were recognized as abdominal emergencies and operation was performed, with 2 survivals; in the remaining cases the condition was recognized only at autopsy. Of the 7 Horton cases, pain was present in only 2. One of these was correctly diagnosed and splenectomy was successfully performed. The remaining 6 were recognized only at autopsy.[166]

On the other hand, almost all the patients with spontaneous rupture in naturally acquired malaria, of whom case reports are available, have experienced severe abdominal pain. The pain of splenic rupture is variable. It is usually generalized, but more acute in the left and upper abdomen than elsewhere; occasionally there is low abdominal pain, which has been attributed to the irritation of blood gravitating to the lower abdomen. Pain radiating to the left shoulder (Kehr's sign) is pathognomonic, but occurs

only in a comparatively small proportion of cases. It was recorded in only 19 out of 68 cases of traumatic rupture reviewed by ZABINSKI and HARKINS.[223] Ballance's sign (persistent dullness in the left flank in all positions and shifting dullness in the right flank), alleged to be specific for rupture of the spleen, is rarely present in spontaneous rupture. The most common finding appears to be generalized abdominal spasm, usually most pronounced in the epigastrium and occasionally in, but rarely limited to, the left upper quadrant. The onset of symptoms may occur with dramatic suddenness or there may be a period of preliminary malaise, depending on how long the bleeding continues before the capsule ruptures.

Delayed haemorrhage in traumatic rupture of the spleen has been the subject of several articles. ZABINSKI and HARKINS [223] recorded 4 cases and analysed 177 others collected from the literature. The subject has also been discussed by KALLIUS [200] and by BUEERMANN.[192] MOORE and CHAPMAN [43] state that in approximately 14 per cent. of traumatic ruptures initial haemorrhage is slight. Bleeding stops and later a secondary haemorrhage occurs with rapid development of shock and collapse; this may occur hours or days later. That a similar course of events may occur in spontaneous rupture is evident from many of the available case reports, including one of the 7 Horton cases.

There is some evidence that spontaneous recovery from rupture of the spleen is possible without surgical interference. WISE [142] recorded the case of a sepoy and CRAWFORD [86] referred to 2 cases reported by RUSSELL in which this was thought to have occurred. In several of the case reports of spontaneous rupture the presence of organized clot has been noted, indicating previous haemorrhage from which the patient had recovered. CORMAN [84] recorded a case from the Belgian Congo in which the patient recovered after presenting symptoms strongly suggestive of subcapsular splenic haemorrhage. ANDREW [67] noted that in a series of 6,038 malarial patients, 10 developed similar symptoms. In all of them there was sudden very acute pain in the left upper abdominal quadrant. In 4 the pain was also severe in the epigastrium and in 6 pain was referred to the tip of the left acromion process. There was also tenderness in the left hypochondrium. The symptoms lasted from a few days to periods of several weeks. The author concluded that in some at least of these the syndrome was probably caused either by a small splenic rupture or by a subcapsular haemorrhage of the spleen. READ *et al.*[176] recorded the case of a general paretic treated with induced *P. vivax* malaria who also recovered after presenting symptoms strongly suggestive of subcapsular splenic rupture.

DIAGNOSIS

The figures cited by HERSHEY and LUBITZ indicate how difficult the diagnosis of spontaneous rupture of the spleen may be. Out of 65 cases a correct diagnosis was made in only 7. As noted above, only one of the seven Horton cases was correctly diagnosed. Where pain is absent and shock profound the condition is commonly attributed to a cardiovascular lesion. Where abdominal pain is present the most common misdiagnosis is a perforated gastric or duodenal ulcer.

The differential diagnosis from perisplenitis, splenic infarct, splenic abscess and volvulus of the spleen is extremely difficult, the only distinguishing feature from rupture being the absence of shock and the greater tendency to spontaneous recovery. The differential diagnosis is discussed in detail by HERSHEY and LUBITZ,[104] MOST and HAYMAN,[207] READ *et al.*[176] and REIMANN and COWLEY.[213]

Treatment

As we have seen, there is reason to believe that recovery from rupture of the spleen may occasionally occur spontaneously. Nevertheless, since this complication, if left untreated, is almost invariably fatal, immediate surgical interference is indicated in all cases. Leighton [112] recorded one case, Marchionni [119] one, and Noland and Watson [125] two others which were treated successfully by tamponade. Splenectomy is, however, the method of choice wherever suitable facilities for such an operation are available.

The operation of splenectomy is said to have been successfully performed in Palermo, Sicily, in the year 1549 by an old lithotomist named Andriano Zaccarello, who also specialized in the extraction of cataracts. A picturesque account of the case was given by Fioravanti [198] who stated that he assisted at the operation. The subject was a Greek woman 24 years of age, and the spleen was described as being " as large as the body could contain ", although after removal the weight was given as only 32 ounces. It was exhibited in the market place for all to see and the woman's recovery was everywhere hailed as a miracle, as indeed it was if the story is true. Pernet,[210] however, expressed grave doubts as to the accuracy of the account, and other medical historians have rejected it altogether.

Best and Schmid [72] analysed data relating to 35 cases of spontaneous rupture of the spleen occurring between the years 1920 and 1945. Of these 14 were not operated on, the condition being discovered post mortem. Of the remaining 21, 17 recovered and 4 died, a mortality of 19 per cent. As far as I am aware, only one successful operation for rupture of the spleen in induced malaria has been reported in the press (Moses [173]).* A second successful splenectomy for this condition was performed at Horton in January 1955.[166]

Needless to say, in rupture of the spleen, massive fluid replacement is almost always necessary. Osadchiy [209] and Erasmus [95] note that in the treatment of this condition great value has been found in the procedure of transfusion of blood collected from the abdominal cavity. The blood is not usually clotted except around the raw surface of the spleen. It should be strained through gauze, citrated and injected in the normal manner.

It must be borne in mind that with removal of the spleen the patient is left without his main bulwark of defence against malarial attack, and it is therefore important that he should not again be exposed to any risk of infection. If the rupture occurred in the course of an infection with *P. vivax* or *P. malariae* a course of treatment with primaquine or pamaquin is indicated with the object of diminishing the risk of relapse. Suppression by an antimalarial drug such as proguanil or pyrimethamine for an indefinite period might also be considered. In any case, the patient should be instructed to report immediately any rise of temperature, so that any relapse of his infection may be promptly dealt with.

Summary

(1) Spontaneous rupture of the spleen has been recorded in a variety of conditions. By far the most common of these is the hyperplasia and engorgement associated with acute malarial infection. The majority of cases occur during the primary attack in non-immune subjects.

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* According to Kaplan *et al.*, [169] a case of recovery following splenectomy in induced malaria was reported by Vermeylen and Vervaeck.[181] There is however no mention of such a case in the paper cited.

(2) There are a number of records in the literature of spontaneous rupture of the apparently normal spleen, although some authorities maintain that this event cannot occur if the organ is in fact normal in every respect.

(3) The incident of spontaneous splenic rupture is probably considerably more frequent than would appear from the literature, owing to the fact that many of the cases are recognized only at autopsy.

(4) The frequency of spontaneous rupture of the spleen in naturally acquired malaria is difficult to assess. It has been estimated to be of the order of 1 in 50,000 cases.

(5) In induced malaria the frequency of this complication is considerably higher, being probably in the neighbourhood of 1 in 1,000 cases of general paralysis treated by malaria therapy.

(6) Spontaneous rupture of the spleen has been recorded in all forms of human malaria, but most frequently in *P. vivax* infections. This is largely because *P. vivax* is the parasite most frequently employed in the practice of malaria therapy.

(7) The pathology, mechanism, clinical features, diagnosis and treatment of spontaneous rupture of the spleen are briefly discussed. Attention is drawn to the importance of protecting persons whose spleen has been removed from risk of further exposure to malarial infection.

(8) Although spontaneous splenic rupture is a rare event, the possibility of its occurrence should be borne in mind, especially by those whose patients reside in, or have visited, malarious countries.

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SUMMARY OF RECENT ABSTRACTS *

VII. HELMINTHIASIS †

Trematodes

Schistosomiasis

General

Meleney (p. 810) regards schistosomiasis as the most important disease of man with the exception of malaria. He gives a general account of progress in methods of control.

Gillet and Wolfs (p. 1070) have contributed a long paper on schistosomiasis in the Belgian Congo. *Schistosoma mansoni* occurs in a broad belt along the south-eastern, eastern and northern frontiers, and in two other foci. *S. haematobium* was introduced from Nyasaland and Northern Rhodesia some 30 years ago; it is found only in Katanga Province. *S. intercalatum* is found in the Lualaba valley only. Methods of treatment and control are discussed. A briefer account of schistosomiasis in the Belgian Congo has been published by Gillet (p. 601).

Schwetz (p. 601) gives an account of the schistosomiasis problem (both urinary and intestinal) in a place in the Belgion Congo, and of his suggestions for eradication of *Physopsis* and *Planorbis* there. At Kongolo in the Belgian Congo he (p. 947) found a high rate of *S. haematobium* infection, and some *S. mansoni*. In Jadotville, Belgian Congo, the African population is infected with both intestinal and vesicular schistosomiasis to the extent of 100 per cent. in the riverine population and 50 per cent. in the city. Urinary infection is especially common in adults (Schwetz, p. 190).

The incidence of both *S. haematobium* and *S. mansoni* infection is high in African, Asian and Coloured people in Natal, South Africa. Schneider (p. 281) took rectal biopsies from 261 patients in a tuberculosis hospital in Durban and found eggs in 68 (26 per cent.). Of these, 36 were *S. haematobium*, 30 *S. mansoni* and 2 mixed infections. He (p. 1072) reports on the incidence of schistosomiasis, based on rectal biopsy, in Africans in the Transvaal; *S. mansoni* infection is high in the north-east and east. Ova of *S. haematobium* were also found in a large number of rectal biopsy specimens.

An account of the schistosomes at present known in Africa has been published by Schwetz *et al.* (p. 809).

A method of staining in which neutral red is used, and which is claimed to differentiate between living and dead larval trematodes, is described by Ishii (p. 812).

Meleney *et al.* (p. 287) have made a detailed study of the histopathology of bisexual infections with *S. mansoni*, *S. japonicum* and *S. haematobium* in animals. The various animals (mice, hamsters, rats, guineapigs, rabbits) reacted in their own characteristic fashions. In general, fertile eggs caused severe lesions, and the eggs of *S. japonicum* were particularly toxic; their effects were studied especially in the liver. The pathology of such lesions is progressive, because the worms themselves survive and continue to deposit fertile eggs, but the lesions caused by living worms were inconstant. The

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* The information from which this series of summaries has been compiled is given in the abstracts which have appeared in the *Tropical Diseases Bulletin*, 1954, v. 51. References to the abstracts are given under the names of the authors quoted, and the pages on which the abstracts are printed.

† For previous articles on helminthiasis in this series see the August and September issues of the *Tropical Diseases Bulletin* each year since 1939.

authors also report on the findings in the intestines, bladder, lung and spleen.

In experiments on immunity Meleney and Moore (p. 1270) found that a monkey infected with *S. mansoni* could not be re-infected with the same strain, and the same was true of a monkey infected with *S. haematobium*, though this animal could be infected with *S. mansoni*. Other work showed that infection with one sex of *S. mansoni* does not produce immunity against normal development of the other sex established subsequently. In immune animals destruction of cercariae probably takes place in the visceral blood vessels at a later stage of development. Serum antibodies were demonstrated in two monkeys; they were not species-specific.

Sera from golden hamsters or monkeys infected with *S. mansoni* or *S. japonicum* caused immobilization of miracidia of *S. mansoni* in dilutions up to 1 in 20. Senterfit (p. 401) shows that the immobilizing activity was present in serum from a monkey infected 5½ years previously, which suggests that the test may be useful for the diagnosis of chronic infections in man.

For the early diagnosis of schistosomiasis in man, Lurie (p. 280) regards the complement-fixation test with cercarial antigen as the best, but a positive reaction does not necessarily imply active infection. In a small series of patients this test became positive by the third week; the cercarial antigen skin test was negative in all.

Pitchford (p. 1073) has made a comparative study of examination of urine and faeces, and of rectal biopsy material, for the diagnosis of schistosomiasis. For *S. mansoni* faeces and biopsy material gave equal results for viable ova, but biopsy was better for non-viable ova. For *S. haematobium* rectal biopsy was considerably better than urine examination, but few of those positive by biopsy showed viable ova. In comment, Gelfand makes the criticism that the specimens examined were not necessarily in parallel from the same persons. Sputum examination for schistosome eggs may be important in the diagnosis of pulmonary schistosomiasis, especially when haemoptysis occurs, and eggs are likely to be numerous (Nor el Din and El Baz, p. 949).

Advanced cor pulmonale due to schistosomiasis is described by El-Ramly and Abdin (p. 404), and El-Ramly *et al.* (p. 602) report a clinical and haemodynamic study of cardio-pulmonary schistosomiasis in which the technique of cardiac catheterization was used. Electrocardiographic studies in pulmonary schistosomiasis are reported by El Sherif (p. 603).

An account of chronic appendicitis in relation to schistosomiasis, in which extensive radiological studies were made, is given by Sirry (p. 950).

The Thorn test, with a single intramuscular injection of corticotrophin, was applied to 26 persons with various helminthic infections, but the results varied, though rather more than half were negative. Galliard *et al.* (p. 808) discuss the subject; the effect of parasitism on the function of the suprarenals appears to be essentially individualistic.

The intensive treatment of schistosomiasis with sodium antimony tartrate has been modified by Talaat (p. 189), who gives 5 injections each of 2 grains of the salt in 20 cc. of 5 per cent. glucose; 2 injections are given each day until the course is finished. The results in 200 patients with urinary schistosomiasis were good.

For the control of schistosomiasis in the Belgian Congo Schwetz (p. 1263) advocates mass treatment with Miracil, but results with Miracil D in Somaliland were not so successful as to suggest to Lipparoni (p. 404) that it should be used for mass treatment.

Deschiens *et al.* (p. 1073) have tested certain basic deoxybenzoins in schistosomiasis. In preliminary tests one of them appeared to be effective in *S. haematobium* infection, and was virtually non-toxic.

Schwetz (p. 701) discusses the confusion in the nomenclature of the snail hosts of African schistosomes, and makes recommendations on the criteria on which classification should be based.

A long and controversial article on African schistosomiasis and the snail hosts has been published by Amberson and Schwartz (p. 394). They group the schistosomes with eggs possessing a terminal spine as subspecies of *S. haematobium*. They discuss snail hosts of the various schistosomes, concluding that for *S. haematobium* there are 3 snail species of *Bulinus*, and for *S. mansoni* the species of *Biomphalaria* can be reduced to one, which has two subspecies. In comment, Gordon regards this as an over-simplification of a complex problem, and contends that the opinions are based on characters of the shells, whereas it is clear that the whole anatomy of the snail should be taken into account. It seems, therefore, that the suggestions of the authors should be examined carefully before they are accepted.

The distribution of *B. truncatus* and *Planorbis* [*Biomphalaria*] *boissyi* in the irrigation system of the Sudan is discussed by Markowski (p. 702) who shows that many factors are concerned, such as velocity and depth of water, character of water, vegetation, etc. The distribution of these two snails determines the incidence of schistosomiasis.

Young snails (*Planorbis*, *Physopsis*, *Lymnaea*), and schistosome ova, can withstand water pressures such as are exerted by centrifugal pumps, but ram pumps do not let snails through. Pitchford (p. 284) states that dams fed by centrifugal pumps readily become infested, but those fed by rams do not. In the indigenous people of Brazzaville there is no schistosomiasis, and there are no snail hosts. Lamy (p. 398) suggests that the absence of aquatic snails may be correlated with the low mineral content of the waters, but the general scantiness of aquatic fauna indicates that some other explanation must exist. Deschiens (p. 1170) shows that carbon dioxide is lethal to *Australorbis glabratus* and *B. contortus* in a concentration of about 1·4 gm. per litre.

In the report of the Bilharzia Snail Destruction Section (Egypt) for 1945–50 (p. 603) it is stated that virtual control has been achieved in the oases of the western desert. The reports for 1950–51 (p. 1263) again show that copper sulphate is used, but not, apparently, the newer molluscicides. In general, infestation is rather less than before. The effect of silt and mud in reducing the concentration of copper sulphate has been investigated, and it is noted that tartaric acid and citric acid stabilize the copper sulphate solution for some hours.

An account of the organization employed in Southern Rhodesia for controlling malaria and schistosomiasis is given by Alves and Blair (p. 13). Six field units make use of copper sulphate for the control of snails in the appropriate season; at other times they are engaged in the control of malaria with BHC. In an attempt to control schistosomiasis on an island in Lake Nyasa Maclean and Hay (p. 951) used copper sulphate on pools, rice fields and a narrow strip of lake edge, and the infected people were treated with lucanthone, with considerable success, though some persons were found positive 5 months after treatment.

In Mozambique both *S. haematobium* and *S. mansoni* are found, and de Azevedo (p. 399) thinks that, because the snail hosts are so widely spread over so large an area, general control is not possible. Propaganda on the importance of personal prophylaxis may be useful, especially in children.

In a test of a number of molluscicides, Wright and Dobrovolny (p. 498) found sodium pentachlorophenate the most effective substance; it is not very toxic to man and is effective in streams if administered at suitable intervals, which are discussed. Experiments show that mud, especially if disturbed, soon reduces the concentration of sodium pentachlorophenate in water, and that sunlight has a similar effect even in clear water. Dobrovolny and Haskins (p. 73) suggest that mud and sunlight may be important factors in reducing efficiency under field conditions. Halawani (p. 1264) reports on the experimental use of sodium pentachlorophenate and dinitro-*o*-cyclohexylphenol in the canal systems of Egypt. In general the results were better than those achieved with copper sulphate.

Experiments with quaternary ammonium compounds indicate that they may be as effective as pentachlorophenate, and they are less toxic to man and animals than other known molluscicides (Vallejo-Freire *et al.*, p. 1076).

Preliminary laboratory tests on certain mercury compounds indicate that, although they are toxic to man and animals, the doses needed to kill snails are so small that they could perhaps be applied safely to waters used by man. Bond and Nolan (p. 609) think that they may supersede pentachlorophenol.

It has been thought that the dried and triturated fruit of *Sapindus saponaria* (which contains a saponin), when used with sodium pentachlorophenate, might be useful as a molluscicide. Barbosa *et al.* (p. 72) report that the mixture has some value, but it is not very great.

BHC alone does not kill snails in a concentration of 10 p.p.m. in 72 hours, but when prepared as an emulsion with benzene, rosin soap and water, it is an effective molluscicide at 10 p.p.m. (Perlowagora-Szumlewicz and de Aguiar, p. 73).

An ostracod crustacean, *Cypridopsis hartwigi*, has been observed experimentally to attack and kill *Bulinus* and *Planorbis* snails; Deschiens *et al.* (p. 1171) suggest the possibility that it might be useful in control.

Schistosoma haematobium infections

In a note on helminthiases in Iraq Denecke (p. 945) notes that *S. haematobium* infection is common; the snail host is *Bulinus contortus*. In part of Persia Ansari and Faghih (p. 399) found extensive infection with *S. haematobium* in one area, where *Bulinus contortus* was prevalent, but few cases from other districts where this snail was not present. Urinary schistosomiasis has been known in Algeria for many years, but recently a new focus has appeared near the town of Algiers; Sabadini and Marill (p. 397) remark on the danger of wide diffusion and the need for prompt control measures.

In part of Upper Senegal the incidence of *S. haematobium* infection is high, but *S. mansoni* is much less common (Garrigue, p. 398). Until recently, however, *S. haematobium* infections have been rare in Oubangui-Chari, French Equatorial Africa, though *S. mansoni* is important. Le Gac *et al.* (p. 397) show that *S. haematobium* is now being introduced.

S. haematobium infection is widespread in Mauritius, and Cowper (p. 496) has confirmed the early finding of Adams that its snail host is *B. forskali*; no other snail host could be found. It is noted that this snail has not been definitely incriminated elsewhere.

Flaschenträger and Taha (p. 280) observe that the optimum *p*H for the hatching and activity of miracidia of *S. haematobium* is between 7·4 and 8.

Little is known about the longevity of schistosomes in man; Berberian *et al.* (p. 188) report a patient who showed eggs of *S. haematobium* in the urine, and of *S. mansoni* in the faeces, 26 years after leaving the focus of infection.

Fibrous tumours of the male genital tract (testis, epididymis and cord) resulting from infection with *S. haematobium* are reported by Camain (p. 188).

Usborne (p. 1261) in Tanganyika analyses the symptoms in urinary schistosomiasis. The usual reason for seeking treatment was painful micturition, but haematuria, frequency of micturation and general weakness were common.

Messent (p. 1171) writes favourably of the treatment of *S. haematobium* infections with Triostam (trivalent sodium antimonyl gluconate).

Deschiens *et al.* (p. 1171) again show that one of the deoxybenzoins, known as 1183 TH, is useful in *S. haematobium* infections.

Schistosoma mansoni infections

A conference on *S. mansoni* infection in Brazil (p. 703) was held in 1952, at which various papers were read and recommendations were made. These recommendations are reproduced in the abstract, and should be read in full; they cover epidemiology, prophylaxis, pathology and treatment.

A high rate of [presumably] *S. mansoni* infection was found in a survey by Schwetz (p. 189) in the Katanga Province of the Belgian Congo. *S. mansoni* infection of a few human cases, and of snails in a dam in South Africa, was traced by Bayer (p. 1260) to pollution of the water with sewage from a sewer which had discharged into the dam for only 10 minutes while a blockage was being cleared.

Australorbis glabratus is widespread in Guadeloupe, and the general incidence of human schistosomiasis is 7·8 per cent. (Deschiens *et al.*, p. 400). An active focus of schistosomiasis has been found in a district of the city of Rio de Janeiro (Deane *et al.*, p. 401).

Barbosa and his colleagues (p. 68 *bis*) have investigated the degree of infection of snails (*A. glabratus* and *Tropicorbis centimetralis*) with *S. mansoni* in parts of Pernambuco, Brazil, and report a survey in man. Infection rates were moderate. de Moura (p. 191) reports the positive results found in examination of faeces for eggs of *S. mansoni*, and of *Australorbis* for cercariae, in Santos, São Paulo. In part of Brazil where 13·8 per cent. of schoolchildren were found infected with *S. mansoni*, Paraense and Santos (p. 403) found a high infection rate in *A. olivaceus* in a large lake, and noted moreover that cercariae can be carried by winds to parts of the lake remote from their primary sites—cases of infection have been reported in persons swimming round a ship anchored 500 metres from the nearest shore. In Bambui County, Brazil, stool examinations indicate a considerable incidence of *S. mansoni* infection: *A. glabratus* is widespread (Dias, p. 400).

S. mansoni infection is common in Salvador, and Travassos (p. 191) found that planorbid snails were infected with cercariae of this species, and shed them at all hours of the day and night from October to March. In slowly moving water a man may be infected by cercariae from snails one kilometre up-stream. He found that opossums are readily infected in the laboratory, and probably in nature; they could easily disseminate the disease.

Ruiz and Coelho (p. 193) have verified hermaphroditism in *S. mansoni* in guineapigs.

The kinetics of lactic dehydrogenases of *S. mansoni* have been studied by Mansour and Bueding (p. 407). A spreading factor has been demonstrated

in suspensions of macerated cercariae of *S. mansoni*, which suggests that they may secrete some substance resembling hyaluronidase (KUNTZ, p. 408), and EVANS (p. 408) has used the streptococcal decapsulation test to demonstrate it.

STANDEN (p. 192) obtained unisexual infections by exposing *A. glabratus* to attack of a single miracidium of *S. mansoni*, and from the resulting cercariae obtained unisexual infection of mice. Male worms when alone show a tendency, not shown by females, to migrate to the mesenteric veins, but the time of migration of paired worms is controlled by the attainment of sexual maturity by the female worms, which tend to remain immature until male infection is introduced.

In experiments on the sex relationship of *S. mansoni* discharged from *A. glabratus*, MOORE *et al.* (p. 1172) found that living mature male worms are essential for the sexual maturation of the female worms; the principal stimulus to sexual maturation of female worms is provided by the products of the males in the act of copulation.

A detailed study of the penetration of cercariae of *S. mansoni* into the skin and lymphatics of mice has been described by STANDEN (p. 285). The cercariae penetrate between the hair follicles by a combination of lytic and mechanical means, they cannot penetrate the deep fascia, and they wander in the subcutaneous connective tissue; on reaching a lymphatic vessel they enter it, and so gain entry into the venous system. Studying the same subject, GRIFFITHS (p. 285) was able to show that speed of migration into the deeper tissues is increased as a result of massive invasion. In an experiment to determine the number of adult *S. mansoni* developing from cercariae applied to mice previously infected by the same species, STIREWALT (p. 286) found evidence of some inhibition of penetration when the interval between the first and second infections was 1 hour, 5 hours or 1 day, but not if it was 2 days, 7 days or 1 month. At an interval of 2 months also the number of adults developing was reduced, but the explanation of this was not evident.

THOMPSON (p. 1174) has studied the host-parasite relationships of *S. mansoni*, especially in relation to re-infection. It seems likely that some immunity may develop in man and perhaps in domestic animals if re-exposures are light and frequent. But man may resemble the guineapig and albino rat in the sense that constant destruction of parasites and eggs is the result of natural resistance rather than acquired resistance. [See also VOGEL and MINNING, below, *S. japonicum* infection.]

A strain of *A. glabratus* from Puerto Rico was found to be very susceptible to infection with *S. mansoni* from Puerto Rico, but a Brazilian strain of that snail was completely refractory. NEWTON (p. 69) shows that susceptibility is a heritable character, and that several genetic factors are probably involved. The Brazilian strain develops a fibrous reaction to the parasite. Offspring of a cross between these two snails show reactions characteristic of each on exposure to *S. mansoni*, and reactions intermediate between the two (NEWTON, p. 1265).

RUIZ (p. 193) reports that *Procyon cancrivorus* is susceptible to *S. mansoni*, and PRICE (p. 288) has shown that the agouti is susceptible to *S. mansoni* infection, and is suitable for laboratory studies which do not require the eggs to be passed in the faeces. BUTTNER (p. 402) has demonstrated that a number of wild rodents from Europe, Asia and Africa can be infected experimentally with *S. mansoni*, with the development of adult worms, and although in this work eggs did not appear in the faeces of all the animals, there is a risk that most of them could act as important reservoirs. Certain rodents. which are listed, have been found naturally infected with *S. mansoni* in Brazil. *Rattus rattus frugivorus* has been

found infected with *S. mansoni* in nature in Pernambuco; Barboso *et al.* (p. 605) recall that infected monkeys and gerbils have also been found elsewhere, and they now think that rats should be seriously considered as a source of human infection. De Amorim *et al.* (pp. 403, 1267) have found *S. mansoni* in wild rats in Brazil, especially *Nectomys*, *Holochilus*, *Oxymycterus*, *Zygodontomys* and *Oryzomys* species. These rodents therefore constitute a substantial reservoir of the infection. Ruiz (p. 1271) shows that *Cuniculus pacca pacca* and *Grison furax* can be infected with *S. mansoni*.

A thesis on the histopathology of pulmonary endarteritis due to *S. mansoni* infection has been published by de Faria (p. 282). Details should be sought in the original abstract. DeWitt (p. 610) has investigated the effect of *S. mansoni* infection on the eosinophil level of mice subjected to adrenalectomy. Daugherty *et al.* (p. 1176) have investigated the effects of *S. mansoni* on the functions of the liver associated with protein metabolism in mice, but little light was thrown on the immediate cause of death.

Maldonado and Acosta-Matienzo (p. 497) tested various methods of examination of faeces for eggs of *S. mansoni*, and conclude that examination of 3 thick preparations, 22 mm. square, from a well-stirred faecal suspension, is satisfactory.

Rodrigues da Silva (p. 404) describes the criteria of activity of eggs of *S. mansoni* in specimens taken at rectal biopsy.

Ruiz (p. 193) describes a perfusion technique for collecting *S. mansoni* from laboratory animals. He (p. 1268) has developed a technique for preparing an antigen from dried and powdered *S. mansoni*, for use in an intradermal test. Comparative tests with this and other well known antigens indicated a slight advantage for the new one. Lurie *et al.* (p. 71) discuss the early diagnosis of *S. mansoni* infection in monkeys; under experimental conditions the first and most reliable sign (at 3 weeks) is a positive complement-fixation test. The same is true of human infection, but in man the skin test may become positive in the 5th week.

From a survey carried out in Brazil, Cardoso (p. 281) concludes that the severity of *S. mansoni* infection is relatively less in Negroes than in white persons.

A case of *S. mansoni* infection showing the signs of the Katayama syndrome, or the early toxaemic stage, is described from Africa by Ritchken and Gelfand (p. 1177), who point out that this condition is more often seen in *S. japonicum* infections.

Meira (p. 1269) reports 28 patients with *S. mansoni* infection and liver and spleen involvement. A study of the hepatic lesions after treatment in experimental *S. mansoni* infection of guineapigs, rats and rabbits shows that the changes differ from those reported in human infections. The basic change is vascular from invasion of the portal venules, and treatment kills a large number of the worms, which are carried to the liver, become autolysed, and give rise to necrosis, embolism, thrombosis and inflammatory changes (Coelho, p. 70).

The various forms of anaemia which may result from *S. mansoni* infection are discussed by Pessôa and Coutinho (p. 605), who also record the leucocyte changes. There is often a relative and absolute eosinophilia, which may even be increased by treatment.

An association of Banti's syndrome with *S. mansoni* infection is discussed by Ruiz Rodríguez (p. 607).

Diaz *et al.* (p. 406) report cure (on a stringent biopsy test) in up to 70 per cent. of persons with *S. mansoni* infection treated by the intensive method with sodium antimony tartrate.

In miners in the Belgian Congo only 191 of 328 found to be passing eggs of *S. mansoni* suffered clinical symptoms. Monteny (p. 1262) reports good clinical results from treatment with various antimonials, and concludes that the actual preparation used is less important than the amount of metallic antimony injected. In *S. mansoni* infections Rodrigues da Silva (p. 405) did not obtain such good results with Miracil D (lucanthone) as have been reported by some other workers, but he points out that lack of uniformity in criteria of cure prevents direct comparison of the relative values of this drug and antimonials. His own criteria were based on rectal biopsy delayed until 4 months after treatment, and were stringent.

Pessôa (p. 284) has found Glucantime and Solustibosan ineffective in *S. mansoni* infection; they appear to have some toxic action on the liver of patients with this disease.

Experiments with some Miracil, acridine and diamidine compounds on *S. mansoni* infections in baboons are reported by Newsome (p. 193); for results the original should be consulted.

Mauzé and Arnaud (p. 1174) write favourably of stannous oxide given by mouth for intestinal schistosomiasis. The dosage was 3 or 4 gm. in divided doses daily for 8 days, the course being repeated on several occasions.

Ranson (p. 948) in an important paper discusses the African Planorbidae, which he distinguishes (as others have done) from the Bulinidae. He emphasizes the importance of the anatomy of the genitalia of the Planorbidae in classification. In comment Hunter stresses the importance of ecological studies on numbers of each snail species, in relation to their capacity to act as hosts to trematodes. Schwetz (pp. 1169, 1260), however, does not agree that the malacological method is capable of solving the problem of classification, and thinks that the conchological characters are of first importance, bearing in mind that "conchology is merely a consequence of ecology". This point of view, which rejects the fundamental rules of nomenclature, is not welcomed by Hunter, who comments on Schwetz's second paper. Schwetz (p. 190) holds that all the African planorbid snails are transmitters of *S. mansoni*, with the exception, possibly, of *P.* [*Biomphalaria*] *smithi* of Lake Edward. He has with difficulty shown that the large snail *P. tanganikanus* is an intermediate host.

Helmy (p. 189) discusses the environmental factors which may affect the irregular distribution of *Planorbis* [*Biomphalaria*] *boissyi* in Egyptian waters, concluding that the essential characters of water are that it should be sufficiently stagnant and sufficiently permanent. The logical weapons of control are therefore current and dryness, which depend on correct canal planning and irrigation control.

Infected *A. glabratus* can survive desiccation but lose the infection about the 20th day (Barbora and Coêlho, p. 1266). They are more susceptible to lack of oxygen than uninfected snails, and lack of oxygen reduces the number of cercariae shed by infected snails. Olivier *et al.* (p. 70) studied their metabolism under these conditions; since snails may be found in almost anaerobic conditions in stagnant pools, the study may be important.

Dreyfuss (p. 497) discusses the Planorbids of Martinique. A tentative key to the Brazilian Planorbidae has been published by de Lucena (p. 403).

Martínez Larré and Ravelo de la Fuente (p. 1075) give an account of schistosomiasis in the Republic of Dominica, where it is very prevalent, and Vaughn *et al.* (p. 1075) report on control of *Australorbis glabratus* there by the use of pentachlorophenate in the form of briquettes or as a surface spray. The results were encouraging. Pessôa (p. 705) has tested a number of molluscicides on *A. glabratus*, finding pentachlorophenol rather more effective

than copper sulphate; the former is particularly useful in still water, and copper sulphate in running water because it acts more quickly.

Preparations of the fruit of *Sapindus saponaria* have a lethal action on *Australorbis glabratus* and in reasonable dilutions are not toxic to animals. Torrealba *et al.* (p. 810) think that they may be useful for control in small foci of this snail.

Certain dyes have a lethal action on cercariae of *S. mansoni* where solutions are exposed to sunlight (Pessôa, p. 705).

Various fish were shown experimentally by Lagrange (p. 406) to be useful in the control of Planorbid snails.

Cruz and Dias (p. 284) have isolated from *Australorbis glabratus* a bacillus, which they name *B. pinottii* and which may be useful in control of the snail hosts of *S. mansoni*, as it is pathogenic to them.

Schistosoma japonicum infections.

Komiya and Ishii (p. 1176) have made a study of the shedding of cercariae of *S. japonicum* by *Oncomelanica nosophora* in Japan.

When mice are exposed to cercariae of *S. japonicum* for only 10 seconds to 2 minutes, only 3–10 per cent. penetrate and reach adult form, but with exposure for 5 minutes 55 per cent. do so. Pan *et al.* (p. 610), however, show that when the skin is rapidly dried with an electric fan after exposure for only 15 seconds, the proportion of cercariae reaching adult form was 66 per cent. They note this hazard of air drying after exposure.

Biopsy of the liver in *S. japonicum* infection showed fatty changes with little fibrosis. Stransky and Pesigan (p. 289) state that most patients with this infection were malnourished, and except for the local reaction round schistosome eggs the changes were similar to those found in malnutrition.

Diagnosis of *S. japonicum* infection by liver needle biopsy was made in one case by Stonehill *et al.* (p. 1076) after rectal biopsy and examination of faeces had failed.

After continued use of an intradermal test for *S. japonicum* infection, in which the antigen was an extract of adult worms or of cercariae, Pesigan *et al.* (p. 952) conclude that false positive results do not exceed 3 per cent. A positive or doubtfully positive result is held to be of specific significance in mass surveys.

In a protracted study of acquired resistance in monkeys to repeated infection by *S. japonicum*, Vogel and Minning (p. 409) found that complete resistance to strong superinfection could be built up. There was also some evidence of cross resistance to *S. mansoni*. An attempt to produce immunity by injecting schistosome material was not successful, and passive immunization with immune serum could not be achieved. Studies were made on the blood picture and the complement-fixation test and on the reaction of the skin to cercariae on first and subsequent exposures. In resistant monkeys the parasites seldom get past the lung arterioles or capillaries, and are probably immobilized by a cellular or humoral factor, and thus killed. Immunity, once established, appears to last for a long time.

Portal hypertension has been observed in patients with *S. mansoni* or *S. japonicum* infection. and Palmer and Jahnke (p. 608) investigated a number of cases. Two patients were treated by end-to-side portal-caval shunt, with reduction in the tension and disappearance of varices. The risk of dissemination of eggs by the shunt operations is probably slight.

Schistosomiasis is widespread in the Philippines, where *Oncomelania quadrasi* is the snail host in the low, flat plains and valleys. Pesigan (p. 74) discusses their ecology and the recommendations which have been

made for control, which include intensification of agriculture, reclamation of marshy land and the building of bridges over streams. Some of the best molluscicides are too expensive for general use. Ritchie *et al.* (p. 289) found *O. nosophora* in marshes in a river valley in Japan, where it will be much more difficult to control than in the terminal ditches and terrace embankments it haunts elsewhere. *O. nosophora* rarely stays in deep water but is usually found in or on moist soil just above the water's edge. Komiya and Yasuraoka (p. 811) have studied its behaviour, pointing out that cercariae emerge only when the snail is in water.

Other Schistosomes

Schwetz (p. 72) describes a new variety of schistosome of wild rodents in the Belgian Congo, *S. mansoni* var. *rodentorum*. A case of schistosomiasis in which eggs with a lateral spine were found in the urine is described by the same author (p. 1072); the eggs bore some resemblance to those of *S. mansoni* var. *rodentorum*. In another paper he (p. 604) sums up existing knowledge of *S. rodhaini* and *S. mansoni* var. *rodentorum*.

Schistosome dermatitis

Schistosome dermatitis has been reported in the Netherlands (Salomé, p. 412).

After a study of the migration of avian schistosomes in mammals, Olivier (p. 194) comes to the conclusion that although their fate in unsensitized persons is not known, analogy with experience in monkeys suggests that they may migrate to the lungs and produce petechial haemorrhages there.

A comparison has been made by Macy and Moore (p. 412) between *Trichobilharzia oregonensis* and *T. elvae*, which cause schistosome dermatitis in America, but which differ markedly in their characters.

Kagan (p. 611) has studied infection of monkeys by *Schistosomatium douthitti*; first exposure leads to dermatitis, and subsequent exposure to a less intense reaction, and monkeys once exposed become relatively resistant. The dermatitis may apparently be due to previous sensitization or to the introduction of a " toxin ".

In an experimental study of schistosome dermatitis, Olivier and Weinstein (p. 413) show that unsensitized rabbits showed little reaction to cercariae, which remained alive for 48 hours, but that in sensitized rabbits the reaction was brisk, with dermatitis, erythema and oedema, and most of the cercariae were dead in 48 hours. Sensitized rabbits were able to destroy the cercariae in the skin.

Wu (p. 413) describes the life cycle of *T. cameroni*.

A marine cercaria known as *Cercaria huttoni* is known to cause schistosome dermatitis. Leigh (p. 499) describes it.

Paragonimus infection

In two Japanese villages Momose *et al.* (p. 195) found a number of persons with eggs of *Paragonimus* in the sputum, or positive skin tests, and in most of them there were nodular and cystic shadows in radiographs of the lungs.

Shirakawa (p. 611) reports the distribution of metacercariae of *Paragonimus* in part of Japan.

In Japan also Yokogawa (p. 75) found *Paragonimus westermani* in 2·8 per cent. of snails (*Semisulcospira libertina*), and discovered a new host, *S. japonica*. He reports observations on the shedding of cercariae, which are apparently rarely shed under natural conditions, most being retained in

the body of the snail. He (p. 290) believes that crabs become infected with *Paragonimus westermani* through the mouth, either indirectly or when they eat the infected snail hosts. He has succeeded in infecting two crabs and a crayfish in this way. He (p. 414) has studied the distribution of metacercariae of *P. westermani* in crabs. The gills were most commonly infected, then the legs and body, but the liver and reproductive organs were also affected.

In several cases of paragonimiasis the eggs could only be found in the faeces, and in others they were present in sputum or in both sputum and faeces. Komiya and Yokogawa (p. 290) conclude that this may be the result of the habit of swallowing sputum, which is commoner in children than in adults.

Roque *et al.* (p. 75) discuss the clinical features of paragonimiasis on the basis of infected American soldiers. Their experience indicates that infection can occur through contaminated drinking water, though it is usually contracted through eating raw or badly cooked fresh-water crustaceans.

Although emetine and sulphonamides together are useful in paragonimiasis, relapses occur, and Momose (p. 612) therefore examined certain other agents for effectiveness against the adult worms. He gives some details. Very encouraging results in the treatment of 3 cases of paragonimiasis with chloroquine are reported by Chung *et al.* (p. 812).

Other trematodes

Komiya and Murase (p. 290) examined specimens of two species of fish, *Pscudorasbora* and *Sarcocheilichthys*, to find the favoured sites of encystment of metacercariae of *Clonorchis sinensis* and other trematodes.

Komiya and Kawana-Tajima (p. 952) have studied the development of the excretory system of *Clonorchis sinensis* in its definitive host.

Viranuvatti and Mettiyawongse (p. 416) report 2 fatal cases of infection with *Opisthorchis viverrina* in Thailand, and claim that this infection is common there.

Stemmermann (pp. 415, 416) reports cases of human infection with *Fasciola gigantica*.

Kant (p. 416) shows that *Fasciolopsis buski* is widespread in part of Bihar, India, and that it encysts on certain tubers in pools. Patients describe a syndrome like that of hookworm infection and dysentery, and most are cured by 5–6 courses of hookworm treatment. A number of cases of *Fasciolopsis buski* infection have been reported in part of Thailand previously thought free, and Sadun and Maiphoom (p. 612) relate the epidemiology to the habit of defaecation into water and the cultivation of the water calthrop (*Trapa bicornis*). Children show the highest rates.

Two cases of infection with *Heterophyes heterophyes* in Greece are described by Sphangos (pp. 291, 813).

Cestodes

Some of the factors which affect the hatching and activation of Taeniid ova are discussed by Silverman (p. 1178).

Ginsberg (p. 813) discusses cysticercosis in cattle in Kenya, where it is common, and stresses the public health importance of this infection, suggesting means of control.

Results in 2 of 3 cases indicate that treatment with diethylcarbamazine may be distinctly useful in human cysticercosis (Mazzotti and Treviño, p. 614).

In some cases patients with tapeworm infection exhibit signs of damage to the liver which may be increased by treatment. Vannfält (p. 500)

discusses the subject. In discussing the treatment of tapeworm infections Schoen and Schneider (p. 76) record 2 deaths after the administration of a preparation of *Filix mas* together with chenopodium or chloroform. They prefer mepacrine or Acranil by duodenal sound (dose 0·7 or 0·8 gm. in water for an adult) followed in half an hour by magnesium sulphate also through the sound, with plenty of water.

Some experimental evidence is provided by Oelkers and Ohnesorge (p. 614) that large doses or extracts of male fern have some toxic effect on the heart.

The treatment of tapeworm infection is not satisfactory, but Anttonen (p. 954) reports considerable success with 0·5 to 0·8 gm. flavaspidic acid in a series of patients infected with *D. latum* (mostly) or *T. saginata*.

Nissen Meyer (p. 954) thinks that mepacrine given twice or 3 times within a week—or in a dose of 2 gm. spread over 2 days—may be the best treatment for *Taenia saginata* infection. For tapeworm infection (mainly *T. saginata*) Kuhls (p. 195) has used a preparation of tin which contains a little zinc chloride (but of which the exact composition is not given). He claims good results and no serious ill effects.

The dried bark of the tree *Albizzia anthelmintica* has been used successfully for tapeworm infection (Teichler, p. 706).

Wigand and Warnecke (p. 196) argue that intestinal worms live under anaerobic conditions and therefore that introduction of air into the duodenum might be an effective treatment for tapeworm infection, and they have treated a number of patients in this way, with success.

In North America the moose and the wolf are the important reservoir hosts of *Echinococcus granulosus*, but Sweatman (p. 77) gives a list of a number of other animal hosts. He discusses the incidence in man in Canada, where dogs may be infected from the wild animals. Increased contact between man, dog and wild animals may lead to an increase in human infection.

In patients with hydatid disease, intradermal injection of hydatid fluid sterilized by Seitz filtration usually causes eosinopenia which may be followed by eosinophilia. Pautrizel and Gosman (p. 500) regard this as a valuable diagnostic test.

By experiments in *Citellus citellus*, Simitch *et al.* (p. 293) have shown that *Hymenolepis nana* and *H. nana* var. *fraterna* of the rat are identical. The metabolism of amino acids by *Hymenolepis nana* has been studied by Aldrich *et al.* (p. 814) who note that castration of the host markedly reduces the rate of activity of the transaminase systems. Mepacrine has been used in the treatment of *H. nana* infections, with only moderate success (Peralta Díaz and Mazzotti, p. 293).

Another record of infection with a cestode of the *Diphyllobothrium latum* group is reported in an Estonian woman in Australia (Sandars, p. 417).

A case of sparganosis is reported from Portuguese East Africa by Alves *et al.* (p. 613), and several from Korea by Weinstein *et al.* (p. 613). Deschiens *et al.* (p. 953) report a case of sparganosis in French Equatorial Africa.

Charles Wilcocks

(*To be continued*)

MALARIA

In this section abstracts are arranged as far as possible in the following order:—Human malaria—*epidemiology, aetiology, transmission, pathology, diagnosis, clinical findings, treatment, control;* Animal malaria—*monkeys, other animals, birds.*

Malaya, Federation of: **Annual Report of the Malaria Advisory Board for the Year 1953** [Anderson, R. E., Chairman]. 16 pp., 1 folding graph. 1954. Kuala Lumpur: Govt. Press. [$1.50; 3s. 6d.]

The Report reviews the annual incidence of malaria reported in Government and estate hospital and dispensaries, which has again shown a decrease and has resumed the general downward trend obvious since 1947 but briefly interrupted in 1951. The reader is, however, warned that complacency could lead to the recrudescence of epidemics. Progress in positive control is briefly reviewed, showing that 572,000 persons are directly protected by residual insecticides excluding the large numbers protected by antilarval measures in major urban areas. Comparison with other South-East Asian countries shows that Malaya is among the leaders in urban control and in technical knowledge but is somewhat behind in the application of this knowledge to rural malaria. Emphasis is laid on the need for enhanced efficiency in work and the need to combine circularized information with positive training.

The circulars "Malaria Control by Modern Methods" [this *Bulletin*, 1952, v. 49, 1098] and "Proguanil" [*ibid.*, 1951, v. 48, 122] have been revised and re-issued, and the latter is here reprinted as an Appendix. [For 1952 Report see this *Bulletin*, 1954, v. 51, 758.] *G. Macdonald*

Jaswant Singh. **Liver Enlargement in Malaria—Need for Extensive Field Surveys.** *Bull. Nat. Soc. India for Malaria & other Mosquito-Borne Dis.* 1955, Jan., v. 3, No. 1, 29–32, 1 diagram. [12 refs.]

The evidence indicating prevalent liver enlargement in association with endemic malaria is briefly reviewed, and the need for a simple method of recording the degree of enlargement set out. It is suggested that a method similar to that devised by Hackett for recording splenic enlargement should be adopted, based on the sub-costal line at the level of the lowest portions of the costal margins on either side and on the trans-umbilical line. Enlargements would then be classified as: 0—not palpable, 1—palpable on deep inspiration, 2—between the costal margin and the sub-costal line, 3—between the sub-costal and trans-umbilical lines, and 4—below the last-mentioned. *G. Macdonald*

Raper, A. B. **Malaria and the Sickling Trait.** *Brit. Med. J.* 1955, May 14, 1186–9.

Allison [this *Bulletin*, 1954, v. 51, 526] had reported that of 290 Ganda children aged 5 months to 5 years seen in the out-patient department of Mulago hospital, Kampala, Uganda, 43 were sicklers of whom 12 (28 per cent.) showed malaria parasites in their blood, but that in the remaining 247 non-sicklers parasitaemia was seen in 113 (46 per cent.). There have been several investigations along these lines carried out before and after

Allison published these striking figures, and none of them confirmed the presence of such a highly significant negative association of sickling and malaria. The present paper investigates the relation of malarial infection to sickling in 5 ways.

One thousand two hundred children under the age of 10, all derived from the Kampala region, were seen at the out-patient department of Mulago Hospital. The author points out that these children are not all necessarily Gandas but includes Nilotes. The parasites seen were *P. falciparum*, *P. malariae* and a few *P. ovale* as well as some which remained unidentified; *P. vivax* was not found. Malaria parasites were detected in 638 of the children, 90 times in 191 sicklers (47 per cent.) and 548 times in 1,009 non-sicklers (54 per cent.). This finding is hardly significant and thus differs greatly from Allison's examination of an identical group of children. However, in addition to the difference in parasitaemia reported by him, Allison had already noted and remarked upon two other observations. The parasite rate in the infected children was greater in his non-sickling group. Of the 12 sicklers with malaria 8 (67 per cent.) had a slight, and 4 a moderate parasitaemia, whereas in the 113 infected non-sicklers slight parasitaemia was seen in 34 per cent. only. Secondly Allison had noted that of the 4 cases in his sickle-cell group with more than slight parasitaemia 3 had *P. malariae*, even though this species is much less common than *P. falciparum* around Kampala. He suggested therefore that the protection afforded by the sickle-cell trait might be more effective against *P. falciparum* than against other species of plasmodia and that African children with the sickle-cell trait may have malaria less frequently or for shorter periods, and perhaps also less severely than children without the trait.

While Raper's results do not confirm Allison's earlier ones as regards a striking negative correlation between malarial infection and sickling, they do provide a firm basis for the tentative suggestions he made on possible differences in parasite rate and specific protection against *P. falciparum*. There was no protection by sickle-cell trait against *P. malariae* or *P. falciparum* under the age of 1, nor was there any noticeable protection against *P. malariae* in the older age-groups; however, above the age of 1 a noticeable negative association of *P. falciparum* infection and sickling was seen—though even this was still much less than the protection reported by Allison against all forms of parasites.

Age in Years	Sickling State	No. of cases	*P. falciparum* No.	*P. falciparum* Per cent.	χ^2
Under 1	Positive	68	32	47	1·15
	Negative	325	130	40	
1–	Positive	59	20	34·4	10·13
	Negative	288	163	71·5	
2–10	Positive	64	21	32·8	7·11
	Negative	396	201	50·8	

Having established a significant difference in the incidence of *P. falciparum* infection in sicklers and non-sicklers, Raper turned to the investigation of the degree of parasitaemia when it was present. It is here where he has made the most striking observations. Field [*ibid.*, 1949, v. 46, 1107] saw in Malaya very few deaths from *P. falciparum* malaria in persons whose parasite counts were under 10,000 per cmm., and no death with a parasite count below 2,300 per cmm. Raper's findings are so remarkable that they are best reproduced here *in toto*.

Distribution of Parasite Densities in 558 Consecutive Infections with P. falciparum in Children under 10 years

Parasite Count per cmm.	72 Sicklers		486 Non-Sicklers	
	No.	% of Total	No.	% of Total
Under 100	20	27·8	55	11·3
100 –	17	23·5	57	11·7
1,000 –	14	19·5	147	30·2
10,000 –	18	25·0	182	37·4
100,000 +	3	4·2	45	9·4

Raper had not noticed a protection by the sickle-cell trait against malaria below the age of 1, even when *P. falciparum* alone was considered. However, when the parasite rate in the infected children was determined a significant advantage of sicklers over non-sicklers was seen even in this age-group. There was less of an effect after two years of age [onset of acquired immunity ?].

Comparison of Incidence of Parasite Counts under 1,000 per cmm. in Sicklers and Non-Sicklers in 558 children infected with P. falciparum

Age in Years	Sickling State	No. of Cases	Cases with Counts under 1,000/cmm.		
			No.	Per Cent	χ^2
Under 1	Positive	30	16	53·3	11·99
	Negative	132	29	29·5	
1–	Positive	20	12	60·0	14·5
	Negative	162	34	20·9	
2–10	Positive	22	9	40·9	2·36
	Negative	192	49	25·5	

The third line of investigation was the examination from April 1952 to October 1954 of 1,194 children tested on first attendance at child welfare clinics in the vicinity of Kampala. Of 192 sicklers, 58 (30 per cent.) showed parasitaemia, while of 1,002 non-sicklers 334 (33·4 per cent.) did so. This difference is insignificant and of the same order as that seen for gross malarial parasitaemia in the 1,200 children attending the out-patients department of Mulago Hospital.

A fourth approach concerned itself with an examination of 663 mothers of some of the children seen at the out-patients department. These women were not ill and were selected only in the sense that they had brought their sick children to hospital. Practically all would possess acquired immunity to the effects of malaria. Of 135 sickling mothers 24 (18 per cent.) showed parasites in the blood, in the 528 non-sicklers 67 (12·7 per cent.) did so. All 91 infections were of a mild degree and all were considered to be of *P. falciparum*. This difference is hardly significant. One would expect that once acquired immunity has entered the scene this mechanism will overshadow other means of protection against malaria such as the sickle-cell trait.

A fifth line of investigation concerned itself with the appearance of the blood films of the children. Three features were encountered more often in sicklers than in the rest: signs of erythropietic activity, well-grown trophozoites and gametocytes. The last were found in 31 per cent. of *P. falciparum* infections in sicklers, and in 21 per cent. of these infections in

non-sicklers. None of these features can be ascribed directly to sicklaemia, but they are all indications of the recovery phase of malaria. The only explanation likely to account for this attendance of sicklers at a later stage of their infection is that their attacks are unusually mild and brief, and that the low parasite counts (*P. falciparum*) seen in the children are a feature of the kind of attacks they experience.

Though Raper has not been able to repeat or explain the extraordinarily striking findings of Allison, he is able to explain now how the somewhat inconclusive reports by other investigators have come about. With the exception of Moore *et al.* [*ibid.*, 1954, v. 51, 1221] these reports refer to hospital patients, and no distinction between the species of parasites was made. Most included adults (who usually possess an acquired immunity against malaria) as well as children. Among such non-immunes as were included, the sicklers would attend hospital less often because of their milder attacks, and so would form a small proportion of all malaria cases diagnosed, thus accounting for a general—though not very significant—tendency to record fewer malarial attacks among sicklers. Even when no selection is employed as in the survey of Moore *et al.* [*loc. cit.*] a very small difference between the two groups could be expected to arise from the probability that sampling at any moment would detect slightly fewer infections in the non-immune sicklers, simply because their attacks are rather briefer. But to arrive at significant figures in such a survey the number of individuals would have to be very great, certainly several times 2,394 which is the number of partially selected cases recorded by Raper. *H. Lehmann*

Beutler, E., Dern, R. J. & Flanagan, C. L. **Effect of Sickle-Cell Trait on Resistance to Malaria.** *Brit. Med. J.* 1955, May 14, 1189–91.

Allison [this *Bulletin*, 1954, v. 51, 526] had injected highly immune Africans with *P. falciparum* and found that only 2 out of 15 sicklers developed malaria, while 14 out of 15 non-sicklers did so. In the present investigation 16 non-immune American Negroes, 8 non-sicklers and 8 sicklers, were injected with *P. falciparum*. Five of each group were inoculated with 500,000 parasites each. There was some difference between the 2 groups on the eighth day and the non-sicklers showed slightly higher parasite counts. The means of the logarithms of the parasite counts of the two groups slightly exceeded two standard errors and may therefore be regarded as statistically significant at the 0·05 level. Earlier comparisons did not reach this level of significance. It was necessary to interrupt the infection in 3 of the non-sicklers before it was necessary to interrupt the infection of any of the sicklers.

After this experiment the remaining 3 volunteers of each group were given an injection of 50,000 parasites each. All became infected, but it was necessary to interrupt the infection in 2 of the 3 non-sicklers before it became necessary to interrupt those of any of the sicklers.

In an attempt to determine the effect of acquired immunity on the resistance of sicklers and non-sicklers to malaria the 2 groups of 5 each which had been inoculated with 500,000 parasites were re-inoculated with 50,000 parasites after a lapse of 4 months. Up to and including the 10th day when treatment was started on one of the non-sicklers, the means of the logarithms of the parasite counts of the sicklers and non-sicklers never differed to a statistically significant degree. Although it was necessary to treat 2 of the 5 non-sicklers relatively early in the course of their infection, the other 3 were able to continue for the remainder of the study (24 days), while only 1 of the 5 sicklers was able to do so.

The authors suggest several possible explanations for the differences between the striking results of Allison and their own "unimpressive differences of questionable significance". Allison used an African and a Malayan strain of *P. falciparum* malaria, whereas they used a Panamanian strain. Allison's subjects were highly immune, theirs were non-immune in the first 2 experiments, and only slightly immune in the third.

[The second explanation is not likely to apply. Raper's findings summarized above make it clear that an advantage of the sickle-cell haemoglobin can be demonstrated only before immunity has been acquired.]

H. Lehmann

Senevet, G., Andarelli, L. & Duzer, A. Présence d'*Anopheles multicolor* Camb. près du littoral algérois. [**Presence of *Anopheles multicolor* in the Algerian Coastal Region**] *Arch. Inst. Pasteur d'Algérie.* 1955, Mar., v. 33, No. 1, 48–50.

Muirhead-Thomson, R. C. **Factors determining the True Reservoir of Infection of *Plasmodium falciparum* and *Wuchereria bancrofti* in a West African Village.** *Trans. Roy. Soc. Trop. Med. & Hyg.* 1954, May, v. 48, No. 3, 208–25. [33 refs.]

This work was undertaken to determine how much each human age-group contributes to the natural infection of *Anopheles gambiae* with *Plasmodium falciparum* under the hyperendemic conditions of villages in the Gold Coast. The parasite index for age-groups was as follows: 0–1 year (86·5 per cent.), 2–4 years (100·0 per cent.), 5–9 years (91·9 per cent.), 10–14 years (70·5 per cent.) and 15 years and over (48·3 per cent.). *P. falciparum* occurred in 94·6 per cent. of 370 positive bloods and the other species in less than 10 per cent. of the cases; one case of *P. ovale* was observed in the 5–9 year group. The *P. falciparum* gametocyte (crescent) rate in these same age-groups was, respectively, 40·4 per cent., 25·8, 14·8, 11·5 and 5·9 per cent. and these high values are attributed to the great care taken before slides were dismissed as negative. Crescents were not usually very numerous; only one person had more than 200 crescents per cmm.

The critical part of this study is the test of the infectivity of crescent carriers, mainly of those younger than 15 years of age, for *A. gambiae*. Batches of 40–50 *A. gambiae* were fed on each carrier and kept at 25°–28°C. afterwards. Dissections were made from the 4th to 7th day so that oöcysts could be recognized as certainly of *P. falciparum*. In a few cases the infection was allowed to proceed to the sporozoite stage; it is thought unlikely that those dissected at the oöcyst stage would have failed to complete development. Allowance should be made for some possibility of missing a single oöcyst on the fourth day which would render the observed incidence of infection rather lower than actuality. Only 12 out of 43 children (infants to 14 years old) showing gametocytes infected the mosquitoes: two out of 13 infants (15 per cent.), three out of 8 in the 2–4 year group (37 per cent.), six out of 16 in the 5–9 year group (37 per cent.) and one of 3 of the 10–14 year group. The infant group of gametocyte carriers was therefore remarkably non-infective, the older children less notable in this respect. Most infants had less than 35 crescents per cmm., the only high counts being 96 and 180 crescents per cmm. (Incidentally, mosquitoes did not feed so readily on infants as on older children; the infants showed marked reactions to the bites.)

Crescent densities of the infectors were quite commonly below 3 per 1,000 leucocytes and in several instances less than 1 per 1,000. About 10 per cent. or less of the mosquitoes feeding on such infectors developed infections, and oöcysts per stomach averaged from 1 to 3. On the other hand, figures for good carriers, some with up to 24 or 30 crescents per 1,000 leucocytes, show that only about one-third of the mosquitoes become infected and oöcysts average about 5 per stomach. It would seem that the first group—with very low gametocyte counts—are, relatively, very competent infectors. It is probable that many of these low gametocyte counts would be dismissed as negative unless intensively examined; persons with this low threshold are called "cryptic" infectors. The contrast is illustrated of several children from 4 months to 7 years old carrying from 3·1 to 7·7 gametocytes per 1,000 leucocytes but failing to infect mosquitoes. It is suggested that trial mosquito feedings on representatives of a population rather than the usual gametocyte incidence based on blood films would be a better guide to the source of mosquito infections in nature. In the present work two men of 20–25 years of age infected the mosquitoes.

Several factors likely to control the source of natural mosquito infections are discussed. It is thought that the present results indicate that the older children and even the adults (numerically the largest age-group and of which 2 out of 30 persons were infective to mosquitoes) are a greater source of infection than the infant group despite the high gametocyte rates in infants.

Dissections of *A. gambiae* and *A. funestus* taken in huts were made in conjunction with this experimental work; precipitin tests revealed a high anthropophilic index. Again, dissections were made for oöcysts 4–7 days after capture to ensure recognition of *P. falciparum* ingested just before capture. The "delayed oöcyst rate" for *A. gambiae* was 16 per cent. of 64 females and 6 per cent. of 231 females for *A. funestus*. *A. gambiae* appears to pick up the malaria parasite more than twice as rapidly as *A. funestus*. The mean density of oöcysts per stomach in wild-caught mosquitoes was 4·6. A high proportion, however, had only 1 or 2, sometimes 5, oöcysts (nearly 80 per cent. of the stomachs). This suggests that many of the anophelines were infected from crescent carriers of rather low infectivity.

During the work, a high incidence of filarial infections—probably all of human origin—was observed in *A. gambiae* and *A. funestus* and test meals at 9 p.m. to 10 p.m. of batches of mosquitoes (*A. gambiae*) were made at random on 40 persons to see if one age-group might be more infective than another. Only 11 persons infected the mosquitoes, the youngest a boy of 5 years and the oldest a man of 75. Infection rates for mature larvae were less than 20 per cent., except for one result in one series with 50 per cent. (of 12 mosquitoes) infected. Numbers of these larvae varied from 1 to 45 per mosquito. Other data indicate that mosquitoes were infected from donors with as few as 16 microfilariae per 20 cmm. but there was no obvious increased mosquito infection rates as the microfilarial density increased to 98 per 20 cmm. Three cases of densities of 120 to 189 microfilariae per 20 cmm. showed, however, a marked increase from 18·2 to 58·3 per cent. infected. The number of mature larvae per mosquito did not, however, show even this amount of direct correlation with microfilarial density in the infector.

Three men were subject to two-hourly blood films and, frequently, mosquito feeds at the same times. The courses of their blood infections were plateau-like rather than peak-like, with not dissimilar densities from 8 p.m. to 4 a.m. Mosquitoes were infected from 8 p.m. to 6 a.m. but the

amount of data does not justify more than the conclusion that test feeds from 9 p.m. to 10 p.m. should give results adequately representative of the infectivity of the infector. Dissections of wild-caught *A. gambiae* and *A. funestus* for filarial larvae suggest that there is a higher mortality with *A. funestus*. Infective larvae occurred in only 0·13 per cent. of the latter, compared with 1·2 per cent. of *A. gambiae*. Infection rates for sausage forms were as high as 55 per cent. It seems probable that in nature the mosquitoes acquire their infections from a diffused reservoir of low-grade infectors although a few persons appear to be very infective.

D. S. Bertram

Merucci, L. Alcune specie di anofeli riscontrate in varie località dello Yemen (Arabia Sud-Occidentale). [**Species of** *Anopheles* **recorded in Various Localities in Yemen**] *Nuovi Ann. d'Igiene e Microbiol.* 1954, Nov.–Dec., v. 5, No. 6, 440–44. English summary.

Some notes are given on the species of *Anopheles* so far recorded from Yemen. The species listed are *turkhudi*, *cinereus*, *sergenti*, *gambiae*, *dthali*, *pharoensis*, *pretoriensis* and *culicifacies* var. *adenensis*. The localities are listed in a table. *H. S. Leeson*

Wilson, D. Bagster & Msangi, A. S. **An Estimate of the Reliability of dipping for Mosquito Larvae.** *East African Med. J.* 1955, Feb., v. 32, No. 2, 37–9.

Because of doubt as to the efficacy of larval dipping as a reflection of the presence and degree of mosquito breeding, the authors compared this method with that for the numerical study of larval populations developed by Christie [this *Bulletin*, 1955, v. 52, 120]. Because of the nature of Christie's technique, the comparison is applicable only to small collections of water: but as these are characteristic of breeding places of *Anopheles gambiae*, the comparison was well suited to East Africa, where the experiments were made.

Three tanks (10 × 8 feet) were covered with earth shaped into a hollow and filled with water to 8 inches in the middle and 1 inch at the margin. Mosquitoes were bred naturally and after 5 to 6 days 4th stage larvae were found. Both anopheline and culicine larvae developed and the former were mostly *A. gambiae*.

The results of searches for varying periods from 5 to 20 minutes are shown in a table. It is clear that dipping revealed only a small percentage of the larvae present: with one exception, the number of larvae was never greater than 36, and was even as low as 6: while by Christie's method the numbers were between 140 and 488.

As the tanks differed in environment from the wells used by Christie, the authors placed laboratory-bred 4th stage larvae of *A. gambiae* in the tanks and left them for 24 hours to become acclimatized. They were then recovered by both methods. A table shows that in 4 experiments in which 2 observers continued dipping for 10 minutes, the average recovery of larvae by Christie's method was 91 and by dipping 33.

There was evidently a 1 in 3 chance of missing larvae in any dip and they might even be missed 4 out of 5 times. Where larvae are rare, they might be missed altogether.

It is concluded that when larvae are scarce and searching is not prolonged, larval dipping must be an unreliable method.

H. J. O'D. Burke-Gaffney

Halcrow, J. G. **Adult Behaviour-Pattern of *Anopheles gambiae* in Mauritius.** [Correspondence.] *Nature*. 1955, Feb. 26, v. 175, 396.

The adult behaviour of *Anopheles gambiae* in Mauritius is defined, according to Senior-White's proposals [this *Bulletin*, 1954, v. 51, 760] as " almost completely endophilic . . .; strongly endophagic and weakly exophagic ". Some data are given in support of the definition and the additional points brought forward that the endophilism (resting indoors) is predominantly in cowsheds, not houses, that the endophagic habit is, correspondingly, a matter of feeding indoors on cattle in their sheds, and, finally, that the few (2·8 per cent.) positive precipitin tests for human blood were probably of mosquitoes which fed in the open (the weakly exophagic habit). [It might have been stressed that Mauritius was treated by DDT residual house sprays from 1949 to 1952. The note appears to be reporting on conditions well after 1952 but certain of the critical figures to support the " strong endophilism " (in cowsheds) are about very low catches in houses quoted from a 1952 report and unpublished data from 1953. One feels a little uneasy about the bearing of previous insecticide treatment on catches, at least in one series carried out so soon after the insecticide treatment.]

D. S. Bertram

Tseng, Po-tsun & Hsieh, Hsien-chen. **Natural Infections of *Anopheles* with Malaria Parasites in Southern Taiwan (Formosa): A Report on Recent Dissections.** *J. Formosan Med. Ass.* 1954, Sept., v. 53, No. 9, 568–72.

Anopheles minimus is judged to be the principal vector of malaria in Taiwan, 0·3 per cent. of over 3,000 dissected being positive, 5 for sporozoites; these were from human habitations. One gut infection was seen in about 6,000 *A. tessellatus* mainly collected from outdoor sites, and also one oöcyst infection out of about 11,000 *A. hyrcanus sinensis* from cowsheds. Negative findings were obtained in 1,109 *A. ludlowi* and fewer of 4 other species of anopheline. Of particular interest was the discovery of an unidentified flagellate in 60 specimens of *A.h. sinensis*, and in 8, 7 and one female of *A. minimus*, *A. tessellatus* and *A. ludlowi*. Most of the female mosquitoes came from cowsheds. It is suggested that previous records of considerable malaria infection rates in *A.h. sinensis* may be erroneous owing to acceptance of these flagellates as sporozoites [Chow *et al.*, this *Bulletin*, 1952, v. 49, 111]. There were 13 females which contained unidentified filarial larvae.

D. S. Bertram

Jaswant Singh & Ramakrishnan, S. P. **Need for a Fresh Approach on Relapse Mechanism in Malaria.** *Indian J. Malariology*. 1954, Sept., v. 8, No. 3, 197–202. [21 refs.]

It is difficult to summarize this interesting paper which should be read in the original. The authors believe that relapse in malaria may be precipitated by the evolution of parasites which have become resistant to the immunity acquired by the host. In their view, parasites which survive during latent infections can be presumed to have become resistant to the " existing degree of host immunity ". When the degree of parasite resistance is greater than that of current (host) immunity, multiplication of parasites occurs and relapse takes place. The hypothesis is discussed especially in relation to human malaria.

B. G. Maegraith

Benazet, F., Sohier, R., Digoutte, J. P. & Sassot, P. Critères diagnostiques du paludisme chez les Européens rapatriés de zones endémie palustre. (Incidences médico-légales.) [**Diagnostic Criteria of Malaria in Europeans repatriated from Areas of Endemic Malaria. Medico-Legal Aspects**] *Bull. Soc. Path Exot.* 1954, v. 47, No. 5, 696–709, 1 fig.

The authors discuss the findings in 450 Europeans in all of whom malarial parasites had been found at least once, sometimes in an endemic area, sometimes in France. All had lived for not less than 6 months or not longer than 18 years in an endemic region and had had irregular chemosuppression, interrupted by metropolitan leave. Of the 320 cases treated in hospital more than half had *P. vivax* infections; most of those seen in the clinic were also infected with *P. vivax*. Others had *P. falciparum* or mixed infections. Two suffered from *P. malariae* infection.

Careful clinical histories were taken covering the stay in the endemic area, the species of *Plasmodium* to which patients were exposed, the date of leaving the area, and some description of the attack in those who were not presenting with fever. The spleen and liver were palpated and measured. The blood was examined for parasites and counts made of both red and white cells. Certain serological tests were also made, *viz.*, so-called liver-function flocculations and 3 " specific " malarial reactions, including that of Henry for haemozoin. Occasional bone-marrow and liver biopsies were performed.

The authors conclude that, short of the demonstration of parasites in the blood, or, in certain conditions, in liver biopsy, there are no certain signs of malaria. Previous residence in an endemic area can be regarded as presumptive evidence, especially if there is an enlarged spleen, in which case other factors may also be significant. Serological reactions tend to be positive during an attack but become negative soon afterwards; the colloidal red reaction persists the longest.

Relapses (species of *Plasmodium* not mentioned) are likely to occur up to 2 years after the patient has left the endemic area, but are rare thereafter.

The authors find that malaria has few sequelae. For instance, persistent enlargement of the liver and deviation of function tests can usually be attributed to other causes. In their view 2 years after leaving the endemic area there is " practically nothing left " of even a severe malarial infection.

The authors consider that an invalid pension might be considered in persons who have lived in an endemic area during the 2 to 3 years preceding repatriation, if malarial infection has been proved. After this time, if they have not been back to the endemic area, compensation should cease.

B. G. Maegraith

Hall, L. A. **Korean *vivax* Malaria. A Statistical Analysis of 95 Patients.** *U.S. Armed Forces Med. J.* 1955, Jan., v. 6, No. 1, 20–34, 2 figs. [16 refs.]

This paper contains a review of the history, clinical features, diagnosis and treatment of 111 attacks of Korean *P. vivax* malaria in 95 patients, aged 17 to 43 years, during 1951–1953. The patients had all received 500 mgm. chloroquine weekly as a suppressive during exposure. Twenty had had previous attacks before admission. Sixteen had been away from Korea 11 months or more. Most attacks in America occurred between May and August.

Diagnosis in these cases was made unnecessarily uncertain by the use of thin blood films examined by " student technicians ": examination of thick films stained by Giemsa is recommended.

Successful treatment with primaquine or some other 8-aminoquinoline was not introduced until 1953. *B. G. Maegraith*

Schmidt, L. H. & Coatney, G. R. **Review of Investigations in Malaria Chemotherapy (U.S.A.) 1946 to 1954.** *Amer. J. Trop. Med. & Hyg.* 1955, Mar., v. 4, No. 2, 208–16.

During the period under review an enormous volume of research on synthetic antimalarials, involving the study of more than 14,000 compounds, was carried out in the United States. Most of these investigations were initiated under the Research Grants programme of the Public Health Service. Subsequent field trials were sponsored by the National Research Council, with the financial support and participation of the Armed Forces.

The first task undertaken was an intensive study of the absorption, distribution, excretion and metabolic transformation of mepacrine. This was followed by researches on the 4-aminoquinolines, of which the most promising proved to be chloroquine, amodiaquine and oxychloroquine. The properties of the British drug, proguanil, were also investigated.

The latter part of the work was largely concerned with studies of the 8-aminoquinolines, with the object of developing a drug which would have the antirelapse properties of pamaquin without its toxicity. This led to the production of primaquine, which was adopted by the United States Army for the routine treatment of *P. vivax* malaria contracted in Korea. From 1950 onwards, extensive studies were undertaken to evaluate the properties of pyrimethamine, which was synthesized in the Wellcome Research Laboratories, New York, and which was found to possess interesting possibilities as a suppressive antimalarial drug.

In the course of these studies significant contributions were made to knowledge of the natural history of simian and human malaria, the development of immunity, the exo-erythrocytic cycle in mammalian malaria and the rôle of the spleen in the pathogenicity of malaria parasites. Advances were also made in the basic knowledge of pharmacology, and some of these were later applied to work on the chemotherapy of leukaemia and poliomyelitis. *G. Covell*

Gelfand, M. **The Management of Malaria.** [Revision Series.] *South African Med. J.* 1955, Jan. 1, v. 29, No. 1, 16–19.

This is one of a series of revision articles and in it the author makes special points of the following: that estimation of the dosage of an antimalarial drug depends on the clinical condition of the patient; that for severe malaria quinine is the drug which should be employed unless its use is contraindicated; if there is vomiting, collapse, dehydration or delirium, an intravenous drip infusion should be set up; that for cerebral malaria quinine should be given intravenously and never intramuscularly; a short course of arsenic combined with the " safer antimalarials " is to be preferred to one of pamaquin for relapses in *Plasmodium vivax* infection; that relapses of malaria are common after operations or confinement. [Some of the points made are highly controversial; for example, not everyone will agree with the recommendations regarding quinine and arsenic.]

A. W. Woodruff

Payet, M., Pene, P. & Barthe, C. Traitement des accès palustres par la quinine subtosan intraveineuse. [**Treatment of Malarial Attacks with Quinine and Subtosan Intravenously**] *Bull. Méd. de l'Afrique Occidentale Française.* 1954, v. 11, No. 1, 101–4.

The authors have treated more than 200 cases of *P. falciparum* malaria with a mixture of quinine and *Subtosanretard* (polyvinyl-pyrrolidone). The mixture was made up fresh in each case, and contained 500–1,000 mgm. of quinine taken up with 5 cc. of 25 per cent. Subtosan. The use of this mixture slows the elimination of quinine from the body so that the blood level remains higher for a longer period. Thus after intravenous injection of 500 mgm. of quinine a blood level of 10–20 mgm. quinine per cent. is reached. The mixture is made up in a 20 cc. syringe and injected at a rate of about 1½ to 2 minutes per each 1 cc. The injection is repeated daily for 5 days.

Of the cases treated 80 per cent. were uncomplicated. Shock, when present, was treated by standard methods. Parasites were present in the blood in all cases.

Side-effects, which occurred in 20 per cent., but were usually transient, included nausea, vomiting, and fast pulse. There was one fatal cardio-vascular collapse in a man aged 50.

The results of treatment were very satisfactory. The authors believe that the treatment should not be used for the old or the very young.

B. G. Maegraith

Chaudhuri, R. N. & Dutta, B. N. **Single Dose Treatment of Malaria.** *J. Indian Med. Ass.* 1955, Apr. 1, v. 24, No. 13, 494–500, 4 figs. [Numerous refs.]

Since 1946, the authors have practised single-dose treatment of malaria in Indian village dispensaries with proguanil, mepacrine, chloroquine, amodiaquine and pyrimethamine.

The total number of patients treated was 439 (*P. falciparum* 190, *P. vivax* 224, *P. malariae* 16, mixed *P. falciparum* and *P. vivax* 9). The dosage prescribed was: proguanil, various amounts from 0·1 to 0·8 gm., mepacrine 0·6 gm., chloroquine 0·6 gm. base, amodiaquine 0·6 gm. base, pyrimethamine 50–100 mgm.

The best results were achieved with chloroquine, amodiaquine and mepacrine, fever and parasitaemia disappearing in the great majority of cases within 48 hours. Proguanil and pyrimethamine proved much slower in action and are not recommended for the treatment of acute malarial attacks.

The authors note that the current price of mepacrine is considerably lower than that of chloroquine and amodiaquine and that it therefore has obvious economic advantages for the treatment of malaria among large communities. No toxic reactions were noted with any of the drugs tested.

G. Covell

Hoekenga, M. T. **The Treatment of Malaria with Hydroxychloroquine.** *Amer. J. Trop. Med. & Hyg.* 1955, Mar., v. 4, No. 2, 221–3.

The subjects of this study were indigenous inhabitants of north-west Honduras, of mixed Indian, Negro and Spanish ancestry. In this part of the country malaria is endemic throughout the year, so that the local population has acquired partial immunity to the local strains of plasmodia.

Hydroxychloroquine (Plaquenil) in a single oral dose of 1·25 gm. was administered to 125 patients (75 *P. vivax*, 50 *P. falciparum*). The results in this group were recorded in a previous paper [this *Bulletin*, 1955, v. 52, 246]. A smaller single oral dose of 0·75 gm. was given to 25 patients (11 *P. vivax*, 14 *P. falciparum*).

Sixty-three patients with *P. falciparum* infections were treated with 0·36 gm. of hydroxychloroquine parenterally, 26 intravenously and 37 intramuscularly. For intravenous injection the drug was given in 500 ml. of normal saline or 5 per cent. glucosaline solution. For intramuscular injection it was given in 9 ml. of normal saline, half into each buttock.

Except with the lower oral dose the results were good, comparing favourably with those obtained with the other 4-aminoquinolines in common use (chloroquine and amodiaquine). No toxic effects were observed with any of the regimens used. *G. Covell*

Bass, B. H. & MacFarlane, R. G. **Treatment of *vivax* Malaria by Pyrimethamine (Daraprim) and Quinine.** *J. Roy. Army Med. Corps.* 1955, Apr., v. 101, No. 2, 153–4.

"1. Fifty-three Service men have been treated for vivax malaria in the past year, using pyrimethamine and quinine. Of these, 26·2 per cent. have relapsed, on an average ninety days after treatment, although the immediate response was good.

"2. No toxic effects of the drugs were met.

"3. The reasons for combining the drugs are discussed.

"4. Pyrimethamine and quinine in these doses is not the treatment of choice for cases of vivax malaria."

Dern, R. J., Beutler, E., Arnold, J., Lorincz, A., Block, M. & Alving. A. S. **Toxicity Studies of Pyrimethamine (Daraprim).** *Amer. J. Trop. Med. & Hyg.* 1955, Mar., v. 4, No. 2, 217–20.

In the course of these trials, pyrimethamine was administered to 214 men. Eighty-one of these, including 40 Negroes, received 25 mgm. of the drug once weekly for 6 months. During this period tests were made for the detection of changes in the peripheral blood, bone-marrow, urine and body weight. No toxic effects were observed. This finding agrees with that of Myatt *et al.* [this *Bulletin*, 1954, v. 51, 531].

One hundred and thirty-three patients, all Caucasians, suffering from malarial attacks, were treated with pyrimethamine under various schedules (of which details are not given). One patient, who had been inoculated with a pyrimethamine-resistant strain of *P. falciparum*, developed severe anaemia and leucopenia. After treatment with chloroquine, haematological recovery was complete after 6 weeks. The pyrimethamine course was then repeated, but neither anaemia nor leucopenia developed. In this group 2 persons developed skin lesions, but these were considered to be incidental findings not related to administration of the drug.

It was concluded that in the whole series of trials there occurred no toxic effects which could unequivocably be attributed to the ingestion of pyrimethamine. *G. Covell*

Belios, G. D. [**Observations and Tests on Anopheline Resistance to the Chlorinated Insecticides in 1953**] *Arch. Hyg.* Athens. 1954, v. 4, Nos. 4/6, 148–76, 1 map and 2 charts. [19 refs.] [In Greek.] English summary 177–9.

A series of observations and tests were made in Greece during 1953 to investigate resistance to chlorinated hydrocarbons which has developed in anophelines since 1950.

In one survey of 33 villages autochthonous primary malaria occurred shortly after house spraying with DDT, showing that *Anopheles sacharovi* had become DDT resistant. During this survey resistance was also observed in *A. superpictus* and *A. maculipennis*.

The resistance of *A. sacharovi* to dieldrin and of *A. superpictus* to dieldrin and chlordane was demonstrated in another area.

From 2,285 questionnaires collected from 88 villages it was found that 84 per cent. of the people used insecticides. Half of them used DDT with or without pyrethrum products; a quarter used BHC; 1·1 per cent. used chlordane; none used dieldrin and the rest used pyrethrum alone.

Further analysis of the replies raised the suspicion that the large amounts, and frequent application, of insecticides increased the degree of resistance of flies, fleas and mosquitoes.

In his summary the author finds among other things that no appreciable resistance is exhibited by aquatic stages of the anophelines but adult anophelines are now widely resistant in Greece, the tendency is spreading and the degree of resistance is increasing. In the worst areas house spraying may now protect for only a month or so whereas formerly the period of protection was 6 months. This will necessitate a second or even a third treatment. One of the causes of this resistance is probably the widespread use of the chlorinated insecticides since 1946. *H. S. Leeson*

Webbe, G. **The Susceptibility of Fourth-Stage Larvae of *Anopheles gambiae* to Oil Solutions of DDT and Dieldrin under Semi-Natural Conditions.** *East African Med. J.* 1955, Feb., v. 32, No. 2, 41–5.

The recommended field dosage of oil solutions of DDT for use against larvae of malaria vectors of East Africa is many times greater than the quantities required to produce 100 per cent. kill in the laboratory.

To discover the cause of this discrepancy a series of tests were made with oil solutions of DDT and dieldrin on a known number of early 4th stage larvae of *Anopheles gambiae* which were introduced into artificially prepared earth pools. The oil solutions were added with a pipette 2 hours later, a control pool being treated with oil only at the same time and rate as the test pools. After 48 hours the surviving larvae were recovered by Christie's method [this *Bulletin*, 1955, v. 52, 120].

Results of the tests are given in 5 tables and for DDT show that there was no appreciable difference in the performance of the insecticides in the laboratory and in the semi-natural conditions of the experiments. The explanation of the previously noticed discrepancy may be found in the failure of oilers to apply the correct dosage, the tendency being to apply too much oil to small places and too little to large ones. Obstruction by vegetation may also play a part.

The tests also confirm that larvae of *A. gambiae* show a higher ratio for susceptibility to dieldrin than to DDT and this effect is enhanced when dieldrin is in oil. *H. S. Leeson*

Ray, A. P. & Nair, C. P. **Liver Enlargement during Acute Infection in Simian Malaria.** *Indian J. Malariology.* 1954, Sept., v. 8, No. 3, 203–8, 1 graph. [18 refs.]

The liver weight and volume were measured in 101 *M. mulatta* monkeys, of which 29 were normal, 49 infected with *P. knowlesi* and 23 with *P. cynomolgi*. The monkeys infected with *P. knowlesi* (presumably by blood inoculation) died in 4–6 days after infection was established and at the peak of infection; those infected with *P. cynomolgi* perished after the crisis in 8 to 15 days. The mean liver volumes in the 3 groups were respectively 107 cc., 156 cc. and 172 cc. The volume and the weight were proportional in all groups.

There is a brief discussion in which a selection of relevant literature is reviewed. The authors suggest that in future malaria surveys the state of the liver should be included, " as the liver is invariably involved in malaria ".

B. G. Maegraith

Lefrou, G. & Martignoles, J. Contribution à l'étude des *Plasmodium* des chimpanzés. Inoculation de *Pl. falciparum* humain au chimpanzé. [**Study of** *Plasmodium* **of the Chimpanzee. Inoculation of Human** *P. falciparum* **to the Chimpanzee**] *Bull. Soc. Path. Exot.* 1954, v. 47, No. 6, 895–903, 1 fig. [11 refs.]

The blood of 20 chimpanzees was examined at Kindia (French Guinea) for malaria parasites, and in 4 (aged about 2 years) scanty ring forms of *Plasmodium reichenowi* were detected. Four months later, an attempt was made to transmit *P. falciparum* from 2 African patients of blood group 0 to 4 chimpanzees of blood group A. Two of the latter animals had previously shown parasites but were now negative. The inoculations were made subcutaneously with 4 cc. of fresh blood. One animal showed rare parasites 5 days later and the infection persisted for 22 days and was accompanied by two bouts of mild fever; the second animal exhibited parasites from the 6th to the 13th day when it died from an intercurrent disease; the third animal had a parasitaemia for 24 days, after an incubation period of 7 days; the fourth animal remained free from malaria.

The authors discuss the possibility that these results might have been due to the lighting-up by " protein shock " of a latent infection, but reject this idea because of the uniformity of their results, and conclude that, like *P. rodhaini*, which is now synonymized with *P. malariae*, the names *P. schwetzi* and *P. reichenowi* should be abandoned in favour of *P. vivax* and *P. falciparum* respectively. [It should be noted, however, that Rodhain (this *Bulletin*, 1948, v. 45, 978) only accepted the identity of the quartan parasites of man and chimpanzee after finding that *P. malariae* would infect the chimpanzee, and that " *P. rodhaini* " would infect man—in other words, that the parasites were interinoculable, behaving similarly in each host. So far, this has not been demonstrated in the case of malignant tertian malaria.]

P. C. C. Garnham

Galliard, H., Lapierre, J. & Murard, J. Évolution de l'infection à *Plasmodium berghei* chez les rats nouveau-nés. [**Course of infection of** *Plasmodium berghei* **in New-Born Rats**] *Bull. Soc. Path. Exot.* 1954, v. 47, No. 6, 885–94, 3 figs. [22 refs.]

In this interesting paper, the authors, after reviewing the literature, try to reconcile the conflicting results obtained by different workers of the effect

of a milk diet on malaria infections, and also report some new observations of their own. Three litters of rats were infected with *Plasmodium berghei*. The first consisted of 6 animals which were inoculated intraperitoneally 13 days after birth with 2 million parasites: a fatal parasitaemia, often interrupted by a transient decline, ensued. The second litter contained 8 animals, half of which were inoculated intraperitoneally and half subcutaneously: a fatal parasitaemia developed in both lots, 3 days earlier in the former where the advancing infection was again temporarily interrupted. The third litter (of 8 animals) came from a mother on a casein-starch diet: intraperitoneal inoculation of parasites led to a fatal infection not exceeding 24 days in length and entirely comparable to the preceding ones, in which the mothers had been on ordinary diets. Lastly, 2 rats a month old were placed on a pasteurized cows' milk diet and were inoculated with *P. berghei*, at the same time as a control: the course of infection was similar in all three.

These results are unlike most British, Indian or Belgian findings, but resemble those obtained by other French, Algerian and Italian workers. The divergence does not seem to be due either to strain of rat or to a nutritional factor; but it might be due to some change undergone by the parasite in different laboratories. Certainly the characters of *P. berghei*, just as those of *P. gallinaceum*, can easily be changed under various conditions, and different species of *Plasmodium* have different metabolic requirements. Finally, it should be remembered that experiments involving *P. berghei*, unlike those of monkey malaria, employ a highly unnatural host, and this alone might be responsible for the discordance of evidence.

P. C. C. Garnham

Fabiani, G. & Orfila, J. Apparition de l'immunité contre " Plasmodium berghei " chez les souris soumises au régime lacté ou à la sulfamidothérapie. [**Appearance of Immunity to** *Plasmodium berghei* **in Rats Kept on a Milk Diet or Treated with Sulphonamides**] *Ann. Inst. Pasteur.* 1955, Jan., v. 88, No. 1, 108–11.

Plasmodium berghei is normally fatal to the white mouse, which appears incapable of acquiring any immunity against this organism. Nevertheless, mice can overcome the infection, either if placed on a milk diet or if dosed with drugs, and the authors attempted to discover if such resistance had an immunological basis. Thirteen mice out of 51 kept on a milk diet and infected with *P. berghei* became cured after a short parasitaemia and 7 were re-inoculated without effect. Return to a normal diet of 12 of the 13 caused the death of 5, a short infection in 3 and no effect in 4; then 4 of the immune animals were re-inoculated, 3 then showed a temporary parasitaemia and one failed to become infected. Finally 2 immunized mice were splenectomized, one while on a milk diet and the other while on a normal diet: no parasites appeared in the blood, denoting the absence of a latent infection, but when parasites were later re-inoculated, a chronic infection, leading to death in a month from anaemia, occurred in one, and a temporary parasitaemia in the other.

Twenty-eight infected mice were treated for 5 days with sulphadiazine and this caused parasites to disappear in 9 mice. Three of the latter underwent a short relapse and these three, with 3 others were re-inoculated. A short parasitaemia followed and parasites returned in one after splenectomy.

Fifteen infected mice were treated with sulphadiazine while on a milk diet; 3 only survived and these were returned to a normal diet after 10 days.

In two of the latter, parasites did not return, but when re-inoculated one died and the other cured itself; in the third, parasites reappeared after return to the normal diet and stayed for a few days—re-inoculation failed to evoke a further parasitaemia, but splenectomy gave rise to a chronic infection.

The sera of the immunized animals showed much more gamma globulin than either normal mice or mice which subsequently died from the infection.

P. C. C. Garnham

Corradetti, A., Toschi, G. & Verolini, F. Comportamento dei componenti proteici del siero durante l'attacco primario nei ratti infetti da *Plasmodium berghei*. [**Behaviour of Serum Proteins during the Primary Attack of** *Plasmodium berghei* **Infection in Rats**] *Riv. di Parassit.* Rome. 1954, July, v. 15, No. 3, 141–50, 1 fig. English summary (7 lines).

The English summary appended to the paper is as follows:—

"The behaviour of the serum proteins was followed during the primary attack on 26 rats infected with *Plasmodium berghei*. The electrophoretic pattern showed a rise in the percentage of the γ globulins at the 12th and 16th days from inoculation, i.e., in correspondence to the usual period of parasitolytic crisis. No significant variations of the serum total N was observed in those rats which were tested for it. The electrophoretic pattern of control rats showed no significant variations of the different protein fractions."

Ramaswamy, A. S., Rama Rao, R. & Sirsi, M. **Histopathological Studies on Chick Malaria infected with** *P. gallinaceum*. *J. Indian Inst. Sci.* 1955, Jan., v. 37, No. 1, 44–52 (Sect. A), 12 figs. on 4 pls. [32 refs.]

Fifteen chicks. 8–12 weeks old, were infected with *Plasmodium gallinaceum*, and were sacrificed 5 to 10 days later, when the organs were fixed and prepared for histological examination. The spleen was 2 or 3 times the normal size and showed peripheral necrosis of the Malpighian follicles with blockage of arterioles by parasitized erythrocytes. Marked phagocytosis was seen in the venous sinuses, both by littoral and wandering cells and there was a strong lymphoid reaction. Localized areas of necrosis occurred in the liver, chiefly confined to the inner two-thirds of the lobule; little hyperplasia of the fixed reticulo-endothelial system was present. The bone-marrow showed a typical erythroblastic response; in the peripheral blood few phagocytes were seen. The infection under these conditions is a fatal one, death resulting not so much from a failure of cellular response, but because of the overwhelming parasitaemia. *P. C. C. Garnham*

BLACKWATER FEVER

Browne, S. G. **A Fatal Case of Blackwater Fever associated with Ingestion of Nivaquine.** *Trans. Roy. Soc. Trop. Med. & Hyg.* 1954, May, v. 48, No. 3, 250–52.

The patient was a Belgian woman of 45 who had been unwell for 3 weeks before admission to hospital. Her main symptoms included diarrhoea,

frequent nausea and vomiting and a dull ache in the liver region. She took suppressive quinine irregularly and "had given herself a dose 'now and again' since the onset of the recent symptoms".

On admission the temperature was raised, liver enlarged, urine normal; scanty *P. falciparum* rings were present in the thick blood smear.

The patient was given sulphasuccinyl [? succinylsulphathiazole] 1·0 gm. t.d.s., chiniofon 0·25 gm. t.d.s. (orally) and Nivaquine 0·20 gm. t.d.s.

On the second day of treatment, after the fifth dose of these drugs, the patient had a rigor and the temperature rose. She passed no urine that day but on the following morning passed 70 cc. slightly acid dark-red urine containing albumin. She became anuric and died on the fifth day. No autopsy was performed.

The author suggests that the patient might have been sensitized by irregular quinine dosage and that Nivaquine, or any antimalarial drug, by causing rapid destruction of parasites, might have precipitated the massive haemolysis. *B. G. Maegraith*

TRYPANOSOMIASIS

In this section abstracts are arranged as far as possible in the following order:—African—*human, animal;* American—*Chagas's disease and other trypanosome infections. In each form the following order is followed*:—*epidemiology, aetiology, transmission, pathology, diagnosis, clinical findings, treatment, control.*

Tanganyika. Medical Department. **Sleeping Sickness Service Annual Report 1954** [Apted, F. I. C.]. 8 mimeographed pp. 1954, Dec. 24.

The incidence of human trypanosomiasis in Tanganyika Territory is rising at present. The number of cases diagnosed from 1st December 1953 to 30th November 1954 was 1,230 compared with 732 in 1953 and 346 in 1952. This total is, however, far short of that of 25 years ago when the disease was epidemic in some large areas of the territory. The Western Province continues to hold its unenviable pre-eminence, and in 1954 it produced more cases than did the whole of the country in 1953.

Apart from any natural control due to a cyclical decrease in the tsetse population the disease is mainly controlled by the maintenance of settlements in which the people live at such a density of population as to render the inhabited area fly-free, but constant vigilance is necessary to keep these settlements in good agricultural order and to keep the people inside them.

Temporary fishing villages are a source of great danger, and expeditions into the tsetse-infested woodlands in search of honey, beeswax and game are followed by many cases of infection. It is remarked that many such fishermen and hunters report regularly to the sleeping sickness dispensaries for blood examination on their return.

A focus of infection on the shore of lake Tanganyika where the infector was considered to be *T. gambiense* produced 63 cases compared with 163 in 1953. This decrease was attributed to the prophylactic use of pentamidine. Mass examination of the 3,000 inhabitants in November 1954 revealed only 16 new infections.

A fresh outbreak in the Lake Province caused the number of cases diagnosed in the district to rise from 6 in 1952 and 38 in 1953 to 175 in

1954. Bush was cleared, and a treatment centre was set up. By the end of June 78 cases had been diagnosed and by the end of November the total was 124, but only 8 had been found in October and 3 in November so that it was considered that the outbreak had been brought under control.

[It is gratifying to see that the Central Province does not appear in the return of cases, as the Kondoa-Irangi district was the scene of a stubborn outbreak which began during the last war and continued for some years.]

The author states that the drug Mel B has proved of great value in treating patients with advanced disease. [It would be of interest to have details of this as *T. rhodesiense* infections involving the central nervous system have hitherto been incurable.] *H. G. Calwell*

Pinto, A. R. Uma modificação dos meios habitualmente usados na hemocultura do *Trypanosoma gambiense*. [**Modification of Common Media used for Blood Culture of** *T. gambiense*] *Anais Inst. Med. Trop.* Lisbon. 1954, Sept.–Dec., v. 11, Nos. 3/4, 573–5.

The English summary appended to the paper is as follows:—

"The author shows that human blood may be substituted by beef blood in the preparation of culture media for *T. gambiense* and that the agar-saline base is more favorable for the development of such Trypanosomes than the agar-Ringer solution base."

de Basto, A. F. X. Estudo da relação entre a albumina e as células do líquido céfalo-raquídeo dos doentes portadores da tripanosomíase rhodesiense. [**Study of the Relationship between Albumin and Cells in the Cerebrospinal Fluid in Patients with** *T. rhodesiense* **Infection**] *Anais Inst. Med. Trop.* Lisbon. 1954, Sept.–Dec., v. 11, Nos. 3/4, 539–71, 8 graphs.

The English summary appended to the paper is as follows:—

"The formula Eq. $A/C. = \frac{\text{Percentage of Albumin}}{\text{No. of cells}} \times 20$ seems quite satisfactory, seeing that all the values which we have obtained with it, both theoretic as those obtained from the examinations of the cerebrospinal fluid were always indicative of the humoral state of equilibrium of the cerebrospinal fluid and consequently of the state of the patient.

"The series of values Eq. A/C.....0,1.....0,36.....1.....3,6 .....4,4..... should be correct and has practical use. It was demonstrated that when its numerical value was equal to or less than 0,1 it was a question of individuals with great humoral alterations, the greater according to the decrease in the numerical value.

"By the same series it is possible to classify and compare various cases, determine which of them has the worst alterations in cerebrospinal fluid.

"From the various values obtained for Eq.A/C., and from the averages obtained for the cells corresponding to certain quantities of albumin we verify parallelism between the quantities of albumin and the number of cells which were only maintained whilst these principles vary between the maximum and minimum values of the series. The parallelism disappears as soon as any of these elements reach abnormal or pathologic values.

"If we consider the necessity to properly classify a patient with sleeping sickness;

"Considering that the classification made with two numbers—quantity

of albumin and number of cells—is more difficult and less explanatory of the state of the patient;

" If we take into consideration that the classification made with only one number represents the relationship between the two principal elements of the cerebrospinal fluid, it is easier and clearer.

" It is our opinion that the proposed formula has practical interest and is necessary as it serves for the exact classification of a patient with sleeping sickness and also to determine the state of humoral equilibrium. Finally it shows in a definite way, the evolution of changes in the albumin content and the cytosis following treatment."

da Silva, J. M. Sobre a tripanosomíase virulenta dos suínos. [**A Trypanosome Pathogenic for Pigs**] *Anais Inst. Med. Trop.* Lisbon. 1954, Sept.–Dec., v. 11, Nos. 3/4, 479–538, 12 figs. on 6 pls. [18 refs.]

The English summary appended to the paper is as follows:—

" Analyzing everything which has been stated it is logical to suppose that:

" a) There exists a trypanosome polymorphic, highly pathogenic for pigs with mixed characteristics of *T. brucei* and *T. simiae*.

" b) This trypanosome has the biological characteristic to transform in the glossinae according to the general table of trypanosomes of the '*group brucei*'.

" c) All the characteristics are found together in the Trypanosome suis Ochmann, 1905, whose individualization from the parasitic and pathogenic point of view is assumed considering the facts indicated."

Espinoza B., L. Infección experimental del *Panstrongylus chinai* por el Tripanosoma cruzi. [**Experimental Infection of *Panstrongylus chinai* with *Trypanosoma cruzi***] *Rev. Ecuatoriana de Hig. y Med. Trop.* Guayaquil. 1954, July–Sept., v. 11, No. 3, 108–9, 2 figs. on pl.

LEISHMANIASIS

In this section abstracts are arranged as far as possible in the following order:—visceral, cutaneous, muco-cutaneous.

Banerji, D. **Possible Congenital Infection of Kala-Azar.** *J. Indian Med. Ass.* 1955, Mar. 1, v. 24, No. 11, 433–5, 1 fig.

" 1. A case of kala-azar occurring in a 7 month old infant whose mother had the disease in the 5th month of pregnancy, is described.

" 2. Clinical cure was obtained with a total dose of 38½ c.c. of stibatin (20 mg. per c.c.).

" 3. The possibility of congenital infection in kala-azar is discussed."

See also p. 848, Nicoli, Sur une nouvelle technique d'étude des phlébotomes (*Nematocera psychodoidea*) [**A New Technique for the Study of *Phlebotomus***].

Kochs, A. G. **Advance in Management of Oriental Leishmaniasis. Preliminary Report.** *Arch. Dermat. & Syph.* 1954, Dec., v. 70, No. 6, Sect. 1, 814–17, 5 figs.

Hitherto several antibiotics have been used in the treatment of oriental sore with varying success, but no report of the use of streptomycin has been seen by the author. He summarizes his observations on the treatment in 133 cases of "Mediterranean Oriental leishmaniasis". [The author's address is Baghdad, Iraq, so presumably most if not all of his cases were encountered there.]

Dihydrostreptomycin was used as a local injection or as a systemic parenteral injection; in some cases both routes were used. The dosage for local injections was 0·25 to 0·5 gm. in 1 to 4 ml. of distilled water. For systemic treatment, a single daily dose of 0·5 to 1·0 gm. and not less than 0·5 gm. for children was given. Adults usually required 5 to 15 gm. and rarely more than 25 gm. The early lesions with little epithelial proliferation responded best to treatment, but all the very varied clinical types eventually responded.

There are 4 before-and-after-treatment photographs that are very impressive; 2 of these show almost complete disappearance of disfiguring facial lesions in one week and 6 days after 3·5 gm. (child) and 5 gm., respectively. [The impression conveyed is that this is a very remarkable advance in the treatment of this disease, but a much fuller report is necessary.]

L. E. Napier

FEVERS OF THE TYPHUS GROUP

In this section abstracts are arranged as far as possible in the following order:—general; louse-borne typhus, flea-borne typhus, mite-borne typhus; rickettsialpox; tick-borne typhus; Q fever, other rickettsial diseases.

Weyer, F. Die Rolle der medizinischen Entomologie in der Rickettsienforschung. [**The Rôle of Medical Entomology in Rickettsia Research**] *Ztschr. f. Angewandte Zool.* 1955, No. 1, 23–36.

Smith, W. W. **The Abundance and Distribution of the Ectoparasites of the House Mouse in Mississippi.** *J. Parasitology.* 1955, Feb., v. 41, No. 1, 58–62, 1 map. [12 refs.]

In connexion with a murine typhus investigation conducted in Mississippi, U.S.A., during 1949 and 1950, a survey was made of the house mouse and its ectoparasites. The 45 localities surveyed are shown on a map. Altogether 4 species of fleas, 1 species of louse and at least 15 species of mites were recorded. Among them were small numbers of the fleas *Xenopsylla cheopis*, *Nosopsyllus fasciatus*, *Leptopsylla segnis* and *Echidnophaga gallinacea* and of the louse *Polyplax spinulosa*. Mites were most numerous and widely distributed and included *Myobia muris-musculi*, *Radfordia affinis*, *Myocoptes musculinus* and *Bdellonyssus bacoti*. *H. S. Leeson*

Sampaio, A. & Faia, Maria de M. Estudo comparativo de algumas reacções sorológicas no diagnóstico da febre escaro-nodular. [**A Comparative Study of Some Serological Reactions in the Diagnosis of Escaro-Nodular Fever**] *Bol. Inst. Superior Hig. Doutor Ricardo Jorge.* Lisbon. 1952, v. 7, 106–17, 1 graph. English summary.

This and the immediately following paper by the same authors provide some interesting glimpses of the features of the form of tick-borne fever of the typhus group which occurs in Portugal. The disease is said to have been first recognized in 1927 by Rebelo and Cardoso who gave it the name "*febre escaro-nodular*". In the present papers it is referred to by the same name and also by the name boutonneuse fever; it is classified as belonging to the Rocky Mountain spotted fever group of rickettsial diseases. The causal rickettsia is referred to alternatively as *Dermacentroxenus conori* and *Rickettsia conori*.

Serological tests were carried out on 233 sera from patients suffering from the disease. Complement-fixation tests with antigens of Rocky Mountain spotted fever and rickettsialpox were found to give much better results than Weil-Felix tests, which were positive in only 32·5 per cent. of the cases. Positive reactions with *Proteus OX19* were appreciably more numerous than those with *Proteus OX2* and in every case the reaction with *Proteus OXK* was negative.

The complement-fixation test with rickettsialpox antigen was positive in as many as 23·5 per cent. of the 68 sera collected within 5 days of the onset and in 84·7 per cent. of 59 sera collected between the 11th and 15th days of the illness; with Rocky Mountain spotted fever antigen the same sera yielded only 8·7 per cent. of positive results within 5 days of the onset and 72·8 per cent. at the later stage. *John W. D. Megaw*

Sampaio, A. & Faia, Maria de M. Contribuição para o estudo da biologia da *Rickettsia conori* em Portugal. [**A Contribution to the Study of the Biology of *Rickettsia conori* in Portugal**] *Bol. Inst. Superior Hig. Doutor Ricardo Jorge.* Lisbon. 1952, v. 7, 118–24.

This paper can be regarded as a continuation of the preceding paper by the same authors. Escaro-nodular fever is said to have greatly increased in recent years, not only in frequency but also in the extent of the affected area. An epidemiological enquiry by the Director-General of Health revealed that in 1950 the disease had spread throughout Portugal and that the yearly incidence was several thousands of cases.

Reference is made to the variability of the clinical features of the disease such as its severity, the presence or absence of an eschar, and the type of the rash.

A brief description is given of the isolation of 15 strains of the rickettsia, 3 from ticks and 12 from the blood of patients on the 4th to the 11th day of the illness. The method employed was intraperitoneal inoculation of guineapigs whose febrile and scrotal reactions were so similar to those caused by *Rickettsia mooseri* that differentiation was possible only by serological tests of the serum of the guineapigs and by cross-immunity tests. The sera of the infected guineapigs gave positive reactions at higher titres with the antigens of the boutonneuse fever and rickettsialpox than with those of Rocky Mountain spotted fever, but this difference was not regarded as proof of a specific difference in the antigens.

A high percentage of success in the recovery of *R. conori* was obtained by inoculating 3 guineapigs at the same time; when no reaction occurred by the 5th day one guineapig was sacrificed and 2 fresh guineapigs were inoculated with suspensions of its splenic tissue. If no reaction occurred by the 7th day in the other guineapigs originally inoculated, one of them was dealt with in the same way and the remaining one was kept for serological tests.

Strains have been maintained up to 20 months by repeated passage through guineapigs without any loss of virulence.

Antigens have been prepared from yolk-sac cultures of the rickettsiae. Among a total of 671 guineapigs inoculated with the strains the following types of reaction were observed:— (a) fever and scrotal reaction 82·8 per cent.; (b) fever without scrotal reaction, 8·6 per cent.; and (c) neither fever nor scrotal reaction, 8·4 per cent. *John W. D. Megaw*

Sampaio, A., da Cruz, A. A. & Faia, Maria M. Outro artropodo infectado com a *Rickettsia dermacentroxenus conori* em Portugal. [**Another Arthropod Infected with** *R. conori* **in Portugal**] *Bol. Inst. Superior Hig. Doutor Ricardo Jorge*. Lisbon. 1952, v. 7, 125–30.

The English summary appended to the paper is as follows:—

"The authors describe for the first time the isolation of *Rickettsia dermacentroxenus conori* (*R. conori*) the etiologic agent of *Boutonneuse fever*, in ticks of the *Genus Boophilus* Curtice 1891 (*B. annulatus calcaratus*?). The strain was serologically identified by the Complement fixation reaction, using M.R. (Rocky Mountain) and R.P. (Rickettsial Pox) antigens; by cross immunity tests with *R. conori* antigens isolated from sick people and from ticks '*Rhipicephalus*' (*R. sanguineus* and *R. bursa*) and with two strains of Murine Typhus fever (*R. mooseri*).

"They think that these '*Boophilus*' may play the role of transmitting Boutonneuse fever and call the attention for the clinical and epidemiological importance."

Raška, K., Syrůček, L. & Kubásek, M. Epidemiologie Q rickettsiosy u nás. Q rickettsiosa—3. Sdělení. [**Epidemiology of Q Fever in Czechoslovakia**] *Československ. Hyg., Epidemiol., Mikrobiol., Imunol.* Prague. 1955, v. 4, No. 1, 26–32. [10 refs.] English summary.

The main reservoir of Q fever infection in Czechoslovakia is in cattle, sheep and other domestic animals. In some herds up to 80 per cent. of the animals are infected; many human cases occur at calving time, when farm workers are contaminated with embryonic fluids containing the causative organism in high titre, and carry the infection on their clothing. Seasonal outbreaks of the disease also occur in association with lambing. Horses, goats and dogs are also affected, and antibody can be demonstrated in several species of birds which come into contact with domestic animals. The organism is excreted in the milk, but transmission by ticks does not seem to be of importance in Czechoslovakia. Q fever is apparently a new disease in Czechoslovakia, and may have been introduced as a result of war-time population movements. *D. J. Bauer*

Syrůček, L., Raška, K., Lím, D. & Havlík, O., with the technical assistance of A. Vejtrubová & H. Zenísková. Nové serologické nálezy Q rickettsiosy u ptáků Q horečka. Sděleni 2. [**Q Rickettsiosis in Birds**] *Československ. Hyg., Epidemiol., Mikrobiol., Imunol.* Prague. 1955, v. 4, No. 1, 22–6. [17 refs.] English summary.

Complement-fixing antibody to Q fever was found in the sera of 12 of 61 hens, 8 of 14 pigeons, and 19 of 148 wild birds of 25 different species taken in the neighbourhood of a focus of Q fever among cattle in Czechoslovakia; no antibody was present in 5 ducks, or in 28 hens taken from an area free from Q fever. Immunity among the wild birds was practically confined to those species which lived in close contact with domestic animals.

D. J. Bauer

Briceño Iragorry, L. & Vogelsang, E. G. Comprobación de anticuerpos contra *C. burneti* (fiebre " Q ") en suero de bovinos. [**Q Fever Antibodies in Sera of Cattle**] *Gac. Méd. de Caracas.* 1954, Nov.–Dec., v. 62, Nos. 11/12, 639–44.

The authors carried out complement-fixation tests for Q fever on sera from 387 cattle of indigenous origin in Maracay, Venezuela, and on sera from 34 imported cattle. " Nine-Mile " antigen was used and a titre of 1 in 32 or more was regarded as positive. Only 1 of the 34 sera from imported cattle was positive at 1 in 32. The authors state that 5·68 per cent. of the indigenous cattle and 7·83 per cent. of the total cattle were positive on the criterion used. [They do not, however, include those having a titre of more than 1 in 32, of which 17 are shown in the tables, which would increase the percentage of positives. Furthermore, the total number of positives at 1 in 32 is shown in the last table as 33, but according to the previous 2 tables it should be 23: this would make the percentage 5·4 and not 7·83.]

H. J. O'D. Burke-Gaffney

Giroud, P. & Jadin, J. Infection latente et conservation de *Rickettsia burneti* chez l'homme; le rôle du pou. [**Latent Infection and Continued Survival of *Rickettsia burneti* in Man: the Rôle of the Louse**] *Bull. Soc. Path. Exot.* 1954, v. 47, No. 6, 764–5.

In an investigation into the part played by ectoparasites in the transmission of *Rickettsia burneti* to man two possibilities were considered by the authors. These were the survival of the rickettsiae in man or in the parasites. It was found that lice from persons in uninfected areas failed to transmit infection to animals, but lice collected from persons living in a place where there had been an epidemic of the disease 2 months previously gave a positive result [this *Bulletin*, 1951, v. 48, 545]. In later experiments it was shown that lice infected with *R. burneti* were affected in exactly the same way as those infected with *Rickettsia prowazeki*, including the early death of the insects. It appeared, therefore, that survival of the rickettsiae in lice could occur only with attenuated strains of the organism, and that it became necessary to fall back on the alternative hypothesis of their survival in man. The presence of *R. burneti* in lice served as a demonstration of the presence of viable rickettsiae in a person whose blood became infective from time to time during a period of several months after his illness.

It was concluded that *R. burneti* can persist in human blood in exactly the same way as *Rickettsia quintana*. It is also known that after an attack

of typhus fever the presence of *R. prowazeki* in the body of the patient can be demonstrated either by finding the organisms in lice from the patient or by inoculation of guineapigs, and that this can happen even during the period of active antibody production.

The experiments referred to in the paper were carried out in the Belgian Congo.

John W. D. Megaw

BARBER, H. **Direct Conglutination with *Rickettsia burneti*, the Causal Agent of Q Fever.** *J. Hygiene.* 1955, Mar., v. 53, No. 1, 63–75, 4 figs. [12 refs.]

Experiments are described in which a comparison is made of the complement-fixation, rickettsia agglutination, and direct-conglutination tests for the diagnosis of Q fever. The last of these tests is a modification of the conglutination test of BORDET and STRENG (1909) who found that erythrocytes sensitized by bacterial antibodies were clumped when a non-haemolytic complement and a substance, which they called conglutinin, found in normal bovine blood, were added. In the direct conglutination test bacteria or rickettsiae are sensitized by antibodies in the presence of guineapig complement and bovine-serum conglutinin. The author found this test, of which he gives full details, much more sensitive than the ordinary agglutination test which was found unsatisfactory in many cases of Q fever studied at the Cambridge University Laboratory.

Sera of volunteers inoculated with killed suspensions of *Rickettsia burneti* and of persons convalescent from Q fever were tested by the above three methods; a close correlation was found to exist between the results of the complement-fixation and the direct conglutination reactions, but the direct agglutination test proved unreliable.

Among 9 control sera from healthy blood donors 3 gave low titre reactions with the direct conglutination test, but negative reactions with the complement-fixation test, and the question arose whether the former test might have indicated a previous infection with Q fever because of its greater sensitivity, or whether it was less specific.

The results of the direct conglutination test are said to be slightly more difficult to read than those of the complement-fixation test but not more difficult than those of the direct agglutination test.

The author discusses the possible reasons for the success of the simple agglutination test in the hands of several workers. Among the suggestions are: (a) that different strains of *R. burneti* vary in their susceptibility to agglutination; and (b) that these workers use fresh sera without inactivation so that they retain variable amounts of complement. They may also contain variable amounts of a conglutinin-like substance so that with fresh serum conglutination rather than agglutination may occur.

The original paper should be read by those interested in the test, which is not likely to be widely used till further trials have been made.

John W. D. Megaw

YELLOW FEVER

In this section abstracts are arranged as far as possible in the following order:—epidemiology, aetiology, transmission, pathology, diagnosis, clinical findings, treatment, control.

Reid, J. A. **A Preliminary *Aedes aegypti* Survey.** *Med. J. Malaya.* 1954, Dec., v. 9, No. 2, 161–8, 1 fig.

The author reports the results of a preliminary survey made in 1952, the purpose of which was to study the prevalence of *Aëdes aegypti* in Malaya. Adults of this insect were found in half or more of the houses searched in Port Swettenham, Klang and Malacca but not in 50 houses in Port Dickson. It is also numerous in villages ("Malay kampongs") near Klang. All the above are coastal. In contrast, in inland areas a small proportion of the houses examined in Kuala Lumpur and other places were found to contain *A. aegypti*. The difference in incidence between the coast and the inland areas is discussed but remains unexplained. *Culex fatigans* was the commonest adult mosquito found in the houses, equally abundant inland and on the coast. A large number of other species of mosquitoes were found during this survey.

It seems that this survey was undertaken to meet the requirements of the International Sanitary Regulations of the World Health Organization due to come into effect in October 1952 [*Bull. Hyg.*, 1952, v. 27, 387]. Under these regulations Malaya must certainly be reckoned as a "yellow-fever receptive area" because *Aëdes aegypti* is present and the population may be assumed to be susceptible to yellow fever so that "conditions would permit its development if introduced". *P. A. Buxton*

Gillett, J. D. & Ross, R. W. **The Laboratory Transmission of Yellow Fever by *Aëdes* (*Stegomyia*) *aegypti* (Linnaeus) from Malaya.** *Ann. Trop. Med. & Parasit.* 1955, Mar., v. 49, No. 1, 63–5. [10 refs.]

Yellow fever is absent from Malaya where, in common with most of South-East Asia, the biological environment for its propagation and maintenance appears to be favourable, where *Aëdes aegypti* is widely distributed, and where susceptible hosts, both man and monkeys, are abundant. Why the disease is absent from Malaya and from other parts of the Orient has long constituted a problem and, as a first step towards investigating this problem, the authors carried out experiments to ascertain whether the Malayan strain of *Aëdes aegypti* can in fact transmit yellow-fever virus. The results are contained in the present paper.

In the experiments the mosquitoes used were second generation female adults obtained from dried eggs of *Aëdes aegypti* brought from Kuala Lumpur by air; the monkeys were two male rhesus (*Macaca mulatta*), one of which, the donor, after intraperitoneal inoculation with $10^{2\cdot9}$ LD50 yellow-fever virus in 0·5 ml. rehydrated monkey serum, circulated virus to a titre of $10^{2\cdot3}$, $10^{5\cdot0}$, $10^{7\cdot2}$ and $>10^{7\cdot5}$ on the 2nd, 3rd, 4th and 5th days (the day of its death), respectively; the other acted as recipient.

Sixty-five of 70 mosquitoes which fed on the donor monkey when the titre of virus in its serum was $10^{7\cdot2}$ or $>10^{7\cdot5}$ proved to contain virus 13–30 days after feeding—a finding which suggests that the Malayan strain is at least efficient as a harbourer of virus.

The capacity of the strain to transmit yellow fever from one monkey to

another was demonstrated as follows: the recipient monkey, on which 20 of the mosquitoes had fed 17 or 18 days after their infective meal on the donor monkey, was shown to contain virus in its serum to a titre of $10^{3\cdot7}$, $10^{6\cdot5}$, $10^{7\cdot7}$ and $10^{8\cdot5}$ on the 2nd, 3rd, 4th and 5th days, respectively; on the 4th day it was ill, with a temperature of 104°F., and on the following day it was sacrificed in a moribund condition. This finding indicates that at least one in 20 of the infected Malayan *Aëdes aegypti* transmitted by bite. As considerable difficulty had been experienced in inducing these Malayan *Aëdes aegypti* to feed, both on the donor and on the recipient monkey, no attempt was made to determine the proportion of infected mosquitoes which can transmit by bite. *G. Stuart*

Floch, H. & Fauran, P. Lutte antipaludique et lutte antiamarile en Guyane Française. Les moustiques vecteurs du virus de la fièvre jaune en Guyane Française. [**Control of Malaria and Yellow Fever in French Guiana: Mosquito Vectors of Yellow Fever**] *Arch. Inst. Pasteur de la Guyane Française. Publication No. 322.* 1954, Apr., 67 pp., 17 figs. [48 refs.]

This little booklet contains illustrated descriptions of adults and larvae of *Aëdes aegypti*, *scapularis*, *serratus*, *taeniorhynchus*, *fluviatilis*, *terrens* and *leucocelaenus*; *Mansonia albicosta*, *fascicolata* and *titillans*; *Psorophora ferox* and *cingulata*; *Haemogogus spegazzinii falco* and *Culex fatigans*.

Keys are given (1) to the generic characters of the adults and larvae of the mosquitoes present in French Guiana; (2) for the identification of the species of *Aëdes* and *Psorophora* by the characters of the adults, the male hypopygium and the larvae; and (3) for the identification of the species of *Mansonia* by the adults and by the male hypopygium.

Brief notes are given on the anti-mosquito campaigns which mostly concern Cayenne. In French Guiana there are 162 species of mosquitoes of which 21 are *Anopheles*, but two important species, *Aëdes aegypti* and *Anopheles darlingi*, have been practically suppressed.

Incidentally there are also 61 species of *Phlebotomus*, 3 species of *Simulium* and 13 species of *Culicoides*. *H. S. Leeson*

Stones, P. B. & Macnamara, F. N. **Encephalitis following Neurotropic Yellow Fever Vaccine administered by Scarification in Nigeria: Epidemiological and Laboratory Studies.** *Trans. Roy. Soc. Trop. Med. & Hyg.* 1955, Mar., v. 49, No. 2, 176–86, 1 fig. [16 refs.]

In the Enugu township of Eastern Nigeria in early 1952 the vaccination of 42,400 of its inhabitants with vaccine prepared at the Pasteur Institute, Dakar, from neurotropic yellow-fever virus and administered by scarification of the skin was followed by 83 cases of encephalitis, with 32 deaths—73 cases, with 29 deaths, among the 19,358 children under 10 years of age and 10 cases, with 3 deaths, among the 23,042 persons over that age. All 83 cases occurred within a 24-day period, with a time lapse of 7 to 23 (mostly 10 to 13) days after vaccination, *i.e.*, a median interval of 11·7 days between vaccination and the onset of encephalitis; no cases occurred among persons who had not been vaccinated.

The clinical findings and the pathology in 5 fatal cases have been described in a previous paper by Macnamara [this *Bulletin*, 1953, v. 50, 808]. The present paper records the results of studies undertaken by the authors to

elucidate the problem of aetiology set by the Enugu outbreak. Neither epidemiological nor virological evidence pointed to the presence of any concomitant or contaminating viral infection, while the absence of evidence of demyelination, together with the minute amount of foreign (mouse brain) protein scratched into the skin of those vaccinated, ruled out the possibility of an allergic condition. A series of laboratory experiments was, therefore, planned to determine the identity of the causal agent and to this end virus isolated from the brain in 3 of the fatal cases was investigated by the inoculation of rhesus monkeys (*Macaca mulatta*) and by specificity tests in mice. Results showed the virus to be a neurotropic strain of yellow-fever virus and not a naturally occurring viscerotropic strain, and to behave in a manner similar to that of the mouse brain virus used in the vaccine. The vaccine virus, and not any adventitious agent, was, therefore, held to be the encephalitogenic factor in the Enugu outbreak. *G. Stuart*

Roodyn, L. **Encephalitis after Yellow Fever Vaccination.** [Correspondence.] *Brit. Med. J.* 1954, Nov. 20, 1226.

In this communication the author refers to 3 cases of meningo-encephalitis, which occurred in infants inoculated within their first 12 months of life with 17D virus vaccine and of which accounts were published during 1954 by, respectively, Smith, Haas, and Scott [this *Bulletin*, 1955, v. 52, 37]. As unprotected infants under one year old are, so far as it can be learned, liable to contract and carry yellow fever in the same way as adults, and as it is not possible, therefore, to exclude from vaccination infants entering and residing in a yellow fever endemic zone, the question of the possible risk attendant on the vaccination of such infants naturally arises. In discussing this question the author draws attention to the omission from the 3 published accounts of any reference to the rôle primary smallpox vaccination, if carried out at about the same time as the yellow-fever vaccination, might have played in causing the subsequent meningo-encephalitis; he also points out that, as meningo-encephalitis has been known to develop in infants who have not been subjected to any immunizing procedure, the possibility that the reactions described might have been coincidental and not the result of yellow-fever vaccination cannot be overlooked.

Basing his opinion on the results obtained at the vaccination clinic of the Hospital for Tropical Diseases, London, where between January 1951 and September 1954 the 17D strain of yellow-fever virus was administered without serious after-effects to 59,189 persons, of whom many were infants 2 weeks to 12 months old, the author concludes that even if the 3 cases " were not merely coincidental, an encephalitic reaction would appear to be of such great rarity that vaccination with the 17D strain of yellow-fever virus should still be regarded as a safe procedure for an infant who will be exposed to the risk of yellow fever (with its high mortality) in an endemic zone ".

[As regards the possible bearing primary smallpox vaccination might have had on the aetiology of the 3 cases, it can be stated that such vaccination (a) had not been carried out in the case reported by Scott; (b) had indeed been performed in the case reported by Smith, but not until 25 days after the infant had left hospital, cured of its meningo-encephalitis; and (c) had, in the case reported by Haas, been carried out one week after the yellow-fever vaccination and 2 days before the onset of nervous symptoms.]

G. Stuart

Cannon, D. A. **Encephalitis after Yellow Fever Vaccination.** [Correspondence.] *Brit. Med. J.* 1955, Apr. 30, 1090.

In England during the period 9th October 1954, to 22nd January 1955, accounts of 4 cases have been published in which infants between the ages of 5 and 13 weeks developed signs of meningo-encephalitis in 9 to 16 days after their inoculation with 17D virus vaccine. These accounts were published by Smith, Haas, Scott and Beet, respectively [this *Bulletin*, 1955, v. 52, 37, 355].

After reviewing these accounts the author sees no evidence that the meningo-encephalitis in any of the cases was necessarily due to the 17D virus. Cases exactly similar to those described occur frequently in infants who have received no protective inoculations. Moreover, other possible explanations of the nervous reactions in these 4 patients are to be found in their clinical histories. In any event the author strongly endorses the view expressed by Roodyn [above, p. 762] on the subject of the vaccination of infants with the 17D strain of yellow-fever virus, namely, that meningo-encephalitic reactions in infants are so rare that it would be quite wrong to withhold vaccination with this strain from one going to an area where yellow fever is endemic. Support to this view is lent by the fact that in Lagos, where during the past 15 years vaccination against yellow fever with 17D virus has been carried out on some 35,000 persons, of whom many were infants, no case of reaction in an infant has been reported. *G. Stuart*

Freire, L. de C. Meningo-encefalite post vacinaçao contra a febre amarela. [**Meningo-Encephalitis after Vaccination against Yellow Fever**] *Rev. Portuguesa de Pediat. e Puericult.* 1955, v. 18, No. 2, 65–71.

The case of meningo-encephalitis recorded in this paper followed the inoculation on 25th September 1954 of a 6-weeks-old baby girl with 17D virus vaccine. The vaccine used had been prepared in Brazil and issued by the Institute of Tropical Medicine, Lisbon. On 6th October, *i.e.*, on the 11th post-vaccination day, the infant suddenly became feverish and restless. Clinical examination 2 hours after onset of symptoms revealed a rectal temperature of 39·5°C. [103·1°F.] and some redness of the fauces but no abnormal signs in the nervous system, abdomen, thorax, or ears. During the night of 6th–7th October the child had two convulsions, and on the morning of 7th October suffered a third, although a less severe, convulsive attack. On 7th October the condition was as follows: temperature was 40·2°–39°C.; moments of somnolence were succeeded by periods of hyperexcitability; there were signs of meningeal irritation; Brudzinski's sign was positive; reflexes were overbrisk; ankle clonus was well marked in the right leg, less so in the left; the cerebrospinal fluid contained albumin 55 mgm. per cent., sugar 75 mgm. per cent., and 360 cellular elements per 1 cmm.—elements among which polymorphonuclears predominated—and proved to be bacteriologically negative; there was no further convulsion. October 8th and 9th brought little change in the child's condition; treatment was with 2 ampoules of gamma globulin, followed by oxytetracycline, and later by quinine suppositories.

Convalescence began on 10th October; the child took her food well, and her reflexes were less brisk. During her convalescence, which was uneventful and uncomplicated by any nervous sequelae, she was given injections of vitamins C and B. When examined one month later, on 8th November, the child was found to be in every respect normal. The electro-encephalographic findings were normal for a 6-weeks-old infant. *G. Stuart*

RABIES

Coonoor. The Pasteur Institute of Southern India, Coonoor. Section B. **Scientific Report 1954. I. Rabies. E. A Case of Hydrophobia following Bat Bite** [Veeraraghavan, N.]. p. 40. 1955. Madras: Diocesan Press.

This is the first case reported from India of hydrophobia following bat bite. It occurred in 1954 in Srikakulam District, Andhra State. The patient was a railway pointsman who picked up an injured bat and was bitten viciously on the forearm near the wrist. Some 3 months later he developed typical hydrophobia and died within 4 days.

Bats in this area are being collected and examined for the presence of natural rabies infection [see also this *Bulletin*, 1954, v. 51, 1240].

H. J. O'D. Burke-Gaffney

Alice, F. J. Cultura do vírus da ráiva bovina em embrião de galinha. [**Chick Embryo Culture of the Bovine Rabies Virus**] *Bol. Fundação Gonçalo Moniz*. Bahia. 1954, May, No. 1, 1–21, 2 figs. [15 refs.] English summary.

A strain of rabies virus was isolated in mice from the brains of cattle infected by vampire bats in the province of Bahia, Brazil, and was adapted to chick embryos by inoculation into the yolk sac of eggs at the 7th day of incubation. The virus was carried through 40 passages in eggs by inoculating a suspension of infected embryos by the yolk sac route, and attained a maximum titre of 10^6 when titrated intracerebrally in mice. After 23 passages the virus had lost its pathogenicity for dogs and rabbits by intramuscular injection. Material from the 27th egg passage produced rabies in 2 calves, but was not pathogenic for dogs, goats, sheep or cattle inoculated in groups ranging from 10 to 17 animals of each kind, and virus from the 30th and 32nd passages was used for vaccinating 99 cattle on estates subject to outbreaks of rabies. Rabbits, guineapigs, dogs, goats, sheep and calves (77 animals in all) inoculated with egg-passage virus were resistant to intramuscular challenge with street virus, and protection against 5,490 LD50 was obtained in a Habel test.

D. J. Bauer

Coonoor. The Pasteur Institute of Southern India, Coonoor. Section B. **Scientific Report 1954. I. Rabies. B. Studies on the Virus Content of the Brains and Submaxillary Glands of Animals which die of Natural Rabies Infection** [Veeraraghavan, N., Balasubramanian, A. & Rangaswami, R.]. pp. 37–9. 1955. Madras: Diocesan Press.

The purpose of these studies was to determine (i) the percentage of animals with brains positive for Negri bodies, that show the presence of virus in the submaxillary glands and (ii) whether there is any correlation between the occurrence of Negri bodies, the virus content of the brain and that of the salivary gland. Histological examination of the brains of 50 animals suspected to have died of rabies was first made; the presence of virus in, or its absence from, the brains and salivary glands of these animals was then ascertained; finally the virus content of the salivary glands of all 50 animals was titrated in mice, as well as that of the 14 animals' brains which were sufficiently well preserved to permit of such virus titration.

Results showed, with respect to (i), that of the 31 animals with Negri bodies present in the brain, 18 (60 per cent.) contained virus in the salivary

glands, *i.e.*, 36 per cent. of the 50 examined; with respect to (ii) that of the 50 animals investigated, Negri bodies in the brain and virus, both in brain and in submaxillary gland, were present in 18, absent from 14; that in 13, with Negri bodies in the brain, virus was present in the brain, but absent from the submaxillary gland; that in 4, with Negri bodies absent from the brain, virus was present both in brain and submaxillary gland; and that in one animal, with Negri bodies absent from the brain, virus was present in the brain but absent from the submaxillary gland—virus having been demonstrated, therefore, in 36 of the brains examined and in 22 of the submaxillary glands. Finally, with respect to the virus contents of brains and submaxillary glands, results showed that titres in the 14 brains, in which estimation was possible, were 10^{-3} in five, $10^{-3\cdot5}$ in one, 10^{-4} in seven, and 10^{-5} in one, those in the 22 specimens of salivary gland, in which virus had been demonstrated, were $<10^{-1}$ in three, 10^{-1} in three, 10^{-2} in three, $10^{-2\cdot67}$ in two, 10^{-3} in four, $10^{-3\cdot5}$ in one, 10^{-4} in three, $10^{-4\cdot5}$ in one and 10^{-5} in two; in one animal only did the virus titre of the submaxillary gland (10^{-5}) exceed that of the brain (10^{-4}). *G. Stuart*

Reagan, R. L., Delaha, E. C. & Brueckner, A. L. **Electron Micrographs of Negri Bodies found in Rabies.** *Texas Reports on Biol. & Med.* 1955, v. 13, No. 1, 157–61, 3 figs.

"Negri bodies in this electron microscopic study seem to have definite internal structure which is in the form of elementary bodies. It was not possible to bring out more detail, probably due in some cases to the combined thickness and density of the Negri body, which partly blocks electron penetration.

"This technique of specimen preparation for electron studies seems to be satisfactory on examination of this rabies strain and confirms our previous work with two other rabies strains. A disinfectant was not used in order to prevent killing the Negri body area which was used for injection of mice to demonstrate its viability and identity."

Coonoor. The Pasteur Institute of Southern India, Coonoor. Section B. **Scientific Report 1954. I. Rabies. F. Action of Cortisone in Hydrophobia** [Veeraraghavan, N. & Chandrasekhar, D. S.]. pp. 40–42. 1955. Madras: Diocesan Press.

The case is described of a 40-year-old woman, who showed her first definite sign of rabies, *viz.*, fear of water, some 35 days after having been bitten on the right leg by a stray dog and who received treatment with cortisone during the 25½ hours which elapsed between the appearance of that sign and the time of her death. Cortisone acetate was administered intramuscularly: 100 mgm. 6½ hours after the sign had become manifest, 50 mgm. 9¾ hours thereafter, and 50 mgm. 6¼ hours later—the last injection having been given 3 hours before the patient's death.

In the authors' opinion the unduly short period of illness might have been due to the influence of cortisone. An impression was also formed that therapy by this means, while not apparently lessening the number of spasms experienced by the patient, did seem considerably to have reduced their severity. An interesting feature of this case was an absence of salivation till the end. *G. Stuart*

Coonoor. The Pasteur Institute of Southern India, Coonoor. Section B. **Scientific Report 1954. I. Rabies. G. Action of Pilocarpine in Hydrophobia** [Balasubramanian, A. & Chandrasekhar, D. S.]. pp. 42–3. 1955. Madras: Diocesan Press.

This paper describes a case of rabies in a 29-year-old man, who had been very severely bitten by a stray dog 67 days prior to the onset of symptoms and who had died after an illness lasting 5 days, of which the last 3 were spent in hospital. In this case the presenting symptom, apart from difficulty in swallowing, dread of water and laryngeal spasm, was an extreme degree of parched tongue and dryness of the mouth—a condition which caused the patient so much suffering that, on the day following his admission to hospital, it was decided to try the action of pilocarpine. Pilocarpine nitrate, administered intramuscularly in a $\frac{1}{4}$-grain dosage, promptly relieved the condition; salivation became profuse 20 minutes after the injection had been given and was still profuse on the following day, the day of the patient's death. The authors consider, therefore, that in the rather rare case of hydrophobia where a patient complains of extreme dryness of the mouth and parched tongue the administration of pilocarpine may be helpful.

In further connexion with this case it is of interest to record that saliva obtained with difficulty from the patient before the administration of pilocarpine and saliva collected immediately after the pilocarpine injection had taken effect were each able, when inoculated intracerebrally into mice in 0·03 ml. amounts, to produce in these animals signs of, and death from, rabies. This finding, taken in conjunction with the results obtained from successfully infecting mice with saliva collected from 3 previous cases of hydrophobia, is contrary to the commonly held belief that human saliva is rarely infectious.

G. Stuart

Fischer, J. Tollwutbekämpfung und Gesundheitsamt. [**The Health Authority and the Control of Rabies**] *Öffentl. Gesundheitsdienst.* Stuttgart. 1955, Mar., v. 16, No. 12, 441–6.

This paper gives an interesting short account of the increase in the world incidence of rabies which has been noted in the last decade. The disease would seem to have been introduced into Germany from South-East Europe. In Bulgaria and Yugoslavia increase in incidence was reported about 1945 and it would appear that this may have been the result of the introduction of wolves from Russia during the war. A large variety of wild and domestic animals have been shown to have become infected, including particularly foxes but also martens, polecats, weasels, badgers, rats, hawks, owls, cattle, sheep, hens, dogs and cats. The disease itself has changed in type in that the incubation period and the prodromal period have become much shorter than had previously been observed. This introduction is followed by a description and discussion of the current methods of legal control and of protective inoculation with particular reference to the contents of the publication of the report of the Robert Koch Institute for 1953.

M. E. Delafield

Hackenthal, H. Studien über den Habeltest. [**Studies on the Habel Test**] *Zent. f. Bakt.* I. Abt. Orig. 1955, Jan., v. 162, Nos. 1/2, 17–23, 6 figs.

In an investigation of the standard method of testing rabies vaccines by the intracerebral challenge of immunized mice it was found that the titre

of the challenge inoculum in unvaccinated controls could be increased by 2 log units by using 2 per cent. horse serum as diluent instead of distilled water, and a somewhat greater effect was produced by rabbit serum. The apparent titre in the vaccinated animals was not affected, and the use of the serum diluent will therefore produce an apparent increase in the effectiveness of the vaccine. *D. J. Bauer*

Coonoor. The Pasteur Institute of Southern India, Coonoor. Section B. **Scientific Report 1954. I. Rabies. A. The Value of 5 per cent Semple Vaccine in Human Treatment—Comparative Mortality among the Treated and Untreated** [Veeraraghavan, N.]. pp. 27–37. 1955. Madras: Diocesan Press.

This brings up to 1953 the study previously reported [this *Bulletin*, 1954, v. 51, 688] and deals with observations on 3,820 bitten persons. The conclusions are similar to those of the previous study. The mortality rate in the treated group was 0·47 per cent. compared with 0·51 per cent. in the earlier study. *H. J. O'D. Burke-Gaffney*

Arnoult, H. Les vaccinations antirabiques à l'Institut Pasteur de Saigon, de 1891 à 1954. [**Anti-Rabies Inoculation at the Pasteur Institute, Saigon, from 1891 to 1954**] *Ann. Inst. Pasteur.* 1955, Apr., v. 88, No. 4, 435–45.

In Indo-China, where rabies is enzootic, specific treatment for persons bitten by rabid animals was first made available at the Pasteur Institute, Saigon, on 15th April 1891. Between that date and 31st December 1953, complete courses of treatment were administered to 52,751 persons. During that period of 62 years treatment was (a) by Pasteur's dried cord method (1891–1947), (b) with either dried cord or Semple-type phenolized vaccine (1st July 1945–31st December 1947) and (c) with Semple-type vaccine only (1st January 1948–31st December 1953). Throughout the period of vaccine production the Louis Pasteur strain of fixed virus was used; the strain, maintained solely in the rabbit, was at its 3,080th passage in 1953.

Of the 52,751 persons treated, 90 per cent. were Asians, 10 per cent. Europeans; 47·5 per cent. were under 15 years of age; 10 per cent. had multiple bites; 30 per cent. had deep wounds; 75 per cent. were bitten through naked skin; 50–60 per cent. were bitten in the lower extremity; and 80 per cent. received treatment within 4 days of their being bitten.

Of the biting animals 80–90 per cent. were dogs, the remainder comprising cats, rats, monkeys and horses, in that order of their biting importance; in 10–15 per cent. proof of rabies was established by laboratory investigation, in 1–3 per cent. on clinical grounds; in 80–90 per cent. rabies was only suspected, while in 0·5 per cent. the animals were free from that disease.

Of the 52,731 persons treated, 44 (0·083 per cent.) died of rabies during treatment or in less than 15 days after its completion, and 47 (0·089 per cent.) died of rabies more than 15 days after the end of treatment and were classified, therefore, as "failures of treatment".

Among the total treated there were 9 (0·017 per cent.) cases of paralytic accident, with 2 deaths. *G. Stuart*

PLAGUE

In this section abstracts are arranged as far as possible in the following order:—epidemiology, aetiology, rodent hosts, transmission, pathology, diagnosis, clinical findings, treatment, control.

Englesberg, E., Gibor, A. & Levy, Judith B. **Adaptive Control of Terminal Respiration in** *Pasteurella pestis*. *J. Bacteriology*. 1954, Aug., v. 68, No. 2, 146–51, 3 figs. [22 refs.]

A comparison has been made between the oxidative metabolism of suspensions of *Pasteurella pestis* grown under aerobic and anaerobic conditions. Aerobically grown cells oxidize glucose rapidly, the end product being mainly CO_2; they also oxidize pyruvate, acetate, succinate, fumarate and malate, but not citrate or α-ketoglutarate. Anaerobically grown cells carry out a slower and incomplete oxidation of glucose, accumulating large amounts of pyruvate and other partial breakdown products whose further oxidation occurs either very slowly or not at all.

Adaptation of anaerobically grown cells to an oxidative metabolism similar to that of aerobically grown cells, can be induced by aeration in the presence of glucose and casein hydrolysate, under conditions where very little cell multiplication occurs. This adaptation is inhibited by ultra-violet irradiation.

Oxygen thus appears to act as an inducer of respiratory enzyme formation in *P. pestis* in the same manner as it does in yeast (Ephrussi and Slonimski, *Biochim. et Biophys. Acta.*, 1950, v. 6, 256).

J. H. Marshall

Englesberg, E., Levy, Judith B. & Gibor, A. **Some Enzymatic Changes accompanying the Shift from Anaerobiosis to Aerobiosis in** *Pasteurella pestis*. *J. Bacteriology*. 1954, Aug., v. 68, No. 2, 178–85, 1 fig. [18 refs.]

These authors have presented evidence that the terminal respiration of *Pasteurella pestis* is under adaptive control (Englesberg *et al.* [above]). In the present paper these results have been extended and supplemented by experiments with cell-free enzyme preparations.

Terminal respiration of aerobic cells appears to be by the tricarboxylic acid cycle. Cell-free extracts oxidize citrate and α-ketoglutarate, as well as other intermediates of the cycle (but not acetate), rapidly, in accord with similar work on other organisms. They also possess free intracellular haematin and a cytochrome. Anaerobic cells lack this mechanism, being deficient in at least isocitric dehydrogenase, aconitase, fumarase and cytochrome and possessing little free haematin.

Aeration of anaerobically grown cells in the presence of casein hydrolysate and glucose, which induces adaptation to an oxidative metabolism, induces the synthesis of isocitric dehydrogenase, aconitase, fumarase, cytochrome and free haematin and causes the disappearance of the characteristic blackening process of anaerobic cells. *J. H. Marshall*

Olitzki, A. L. **The Resistance of** *Microtus guentheri* **to Infection by** *Pasteurella pestis*. [Correspondence.] *Trans. Roy. Soc. Trop. Med. & Hyg.* 1955, Mar., v. 49, No. 2, 197–8.

The author, from Jerusalem, refers to the letter from Sir William MacArthur [this *Bulletin*, 1952, v. 49, 1111] in which he challenged the

suggestion that the Biblical "mice that mar the land" might refer to *Microtus guentheri*. He points out that this rodent is still present in the coastal plain of Israel, sometimes in enormous numbers.

He shows in a table the results of inoculating 29 *M. guentheri* with numbers of *P. pestis* varying between 10^3 and 10^9. All but 3 survived the 3-month period of observation and the remainder were killed at intervals and their organs cultured.

P. pestis was obtained after 2 weeks from abscesses in 2 animals which had received 10^3 micro-organisms and from the spleen and an abscess of another 6 weeks after inoculation of 10^6 organisms. The remaining 23 animals gave negative cultures. Evidently *M. guentheri* is relatively resistant to massive doses of *P. pestis*, which killed most of the control white mice used in the experiments.

The author therefore [apparently on these grounds] rejects the theory that the field mouse *M. guentheri* was the immediate cause of the epidemic plague among the Philistines. *H. J. O'D. Burke-Gaffney*

Hoyer, B. H. & Courdurier, J. **Detection of Plague Antigens in Tissues of Persons Dead from Plague.** *Bull. Soc. Path. Exot.* 1954, v. 47, No. 6, 758–9.

This is a brief note on 4 cases of plague of which 2 were septicaemic, and the other two were bubonic and pneumonic, respectively. In all 4 cases the presence of antigens of *Pasteurella pestis* was demonstrated in suspensions of the body tissues which were removed after death. A precipitin test was carried out by mixing suitable dilutions of Lederle antiplague rabbit-serum-globulin with saline extracts of pooled suspensions of the body tissues; the mixtures were incubated in capillary tubes at 37°C. for 3 hours and then were kept at 4°C. for 12 hours. The precipitin titres ranged from 1 in 4 to 1 in 32. Preliminary tests had been made in each case by the procedure followed in Madagascar in all cases in which death was suspected to have been due to plague, *viz.*, by examining stained smears of the fluid obtained by puncturing the lungs, liver and buboes. In all the cases bacilli with the characteristic appearance of *P. pestis* were seen. In 2 out of 3 cases the application of the suspensions to the excoriated skin of guineapigs caused plague. The negative result followed the application of the suspension whose precipitin titre was 1 in 4. In the positive cases the titres were 1 in 8 and 1 in 32, respectively. *John W. D. Megaw*

CHOLERA

In this section abstracts are arranged as far as possible in the following order:—epidemiology, aetiology, pathology, diagnosis, clinical findings, treatment, control.

Swaroop, S. & Pollitzer, R. **Cholera Studies. 2. World Incidence.** *Bull. World Health Organization.* Geneva. 1955, v. 12, No. 3, 311–58, 13 figs. [31 refs.]

In the first part of these studies [this *Bulletin*, 1954, v. 51, 1154] Pollitzer had given (a) an account of the early history of cholera up to 1817, so far as it could be ascertained, the disease being until then almost entirely confined to India; and (b) a more detailed account of its subsequent

distribution in the years between 1817 and 1923, during which spread occurred both east and west in a series of pandemic waves involving several continents and causing high mortality. Swaroop and Pollitzer now analyse the situation from 1923 onwards, during which the disease again became limited to India and the Far East for the most part, with only minor extensions beyond Afghanistan and a single isolated outbreak in Egypt. The information available from the records collected during a period of over 100 years, and the numerous statistical studies which have been published, now provide a basis of knowledge on the epidemiology of cholera in its geographical, seasonal, climatological and other aspects which should lead to a full understanding of the disease.

Cholera endemic foci. As it has been shown that each major epidemic spread has originated from India the demarcation of the areas in India in which cholera can be considered to be endemic has been undertaken. Cholera is found to be present year by year at high level in Bengal, in the deltaic region of the Ganges and Bramahputra extending eastwards in Assam and westwards into Bihar and possibly to the eastern districts of Uttar Pradesh. Endemic foci of lower magnitude also exist in the deltas of the Mahanadi in Orissa State, the Cauvery, the Kristna and the Gadavari in Madras and possibly also in the Irrawaddy delta in Burma. These areas have the characteristics in common that they are situated in relation to surface water systems at or near the coast and lie at a low altitude, hardly over 50 feet above sea level and are densely populated. Although these areas are considered to be endemic foci it has not been possible so far to trace the manner in which infection is maintained in them or the method of infection from patient to patient, especially in inter-epidemic periods. [A serious gap in our knowledge of cholera.]

Other large areas of India, although they suffer from epidemics of considerable magnitude, at times are often free from the disease for prolonged periods and can be excluded as endemic zones.

Pilgrimages and festivals. The part played by these assemblies in *spreading* cholera and causing violent epidemics in non-endemic areas is commented on. They do not, however, have an influence in *maintaining* endemic foci.

Seasonal factors. The seasonal incidence of cholera in different parts of India is well marked and consistent for each area. In Bengal incidence rises during September to November, a first peak being reached in December and January. A second peak occurs in March–April. In Bihar and Uttar Pradesh the winter months are unfavourable to spread and the peak of infection is in the spring. Highest incidence in the Punjab is later, July and August, and this determines the timing of infection in Afghanistan and of subsequent spread westwards by the land route through Iran onwards. Following infection in Uttar Pradesh infection spreads through central India southwards to Madras and Bombay and may then be carried by sea from Bombay westwards. Spread eastwards is by sea, seaports in that part of the world being primarily infected with subsequent extension into the interior.

Disappearance of cholera from the West. Table No. 1, which gives the figures of cholera deaths throughout the world for the years 1900 to 1952 inclusive, shows the complete disappearance of the disease from Europe after 1923 even though severe epidemic conditions continued in India. The last heavy incidence in Europe was in the U.S.S.R. where, in European Russia in 1921, a total of 207,389 cases were recorded. The figure for 1922 was 86,178 and for 1923 only 114. Only a few odd cases were recorded in the subsequent 3 years.

Cholera in non-European countries west of India. The countries west of India infected after 1923 were Iraq, Iran and Egypt. Iraq had an epidemic of 1,503 cases in 1923, the disease disappearing by the end of the year. Two subsequent epidemics occurred in 1927 and 1931, infection carried by sea being first established in Basra and then spreading along the Tigris and Euphrates. Since 1932 the country has been free from cholera. Iran had an epidemic in 1923 which had its origin in the outbreak in Basra in the same year. Epidemics also occurred in the same manner in 1927 and 1931. Following a high incidence in the Punjab in 1938 cholera spread to Afghanistan and on into Iran in 1939 and caused a short outbreak which lasted only two months and caused 307 deaths. Afghanistan had outbreaks in 1930, 1936, 1937 and 1938 by spread from Northern India. the deaths in the two latter years being 2,141 and 849, respectively. Very small outbreaks were reported in 1941 and 1946.

Apart from these outbreaks in Iraq and Iran due to spread by sea to Basra and in Afghanistan and Iran by spread by the land route from India, the only cholera in the period 1923 to 1952 west of India was a sharp epidemic in Egypt in 1947 and a very small group of cases in Syria in the following year. Egypt had been free from cholera in epidemic form for 45 years when the disease broke out in September of that year. A total of 32,978 cases occurred with 20,472 deaths in a period of about 3 months after which the epidemic came to an end and there was no evidence of residual infection. At the time of the commencement of the outbreak there was no cholera anywhere west of India and in spite of most detailed investigation on the possible method of introduction of the infection its source could not be traced. The freedom of Egypt from cholera for many years has been attributed to the protection afforded by the International Sanitary Conventions and in particular the special provisions in regard to the Pilgrimage to the Hedjaz. Formerly when the pilgrimage was infected, as frequently happened, pilgrims returning to Egypt introduced the disease. The Pilgrimage has, however, been free from cholera since 1913. In the end of December 1947 and the beginning of 1948 when cholera had almost disappeared from Egypt a small number of cases occurred in villages of the Hauran Province of Syria. The exact method of introduction of infection was not traced.

The next section of the studies gives an account of the incidence of cholera in India and countries to the east of it in the period under review.

Cholera in Insular Countries of Asia. The Philippines. After a very considerable annual incidence up to 1920 with continuance at low level to 1924 cholera was epidemic at moderate level during 1925 and 1926. Another epidemic wave commenced in 1930 and lasted for 5 years: since 1938 the Philippines have been free from cholera.

Indonesia. The island of Java, after a major epidemic in 1918 and 1919, had only a few sporadic cases in the following years and has now been free from the disease for over a quarter of a century. Cases of choleriform disease, however, occurred in the Celebes in the years 1937 to 1940 which are of special interest. These were few in number and widely scattered in time and place and did not occur in the explosive epidemic manner characteristic of cholera. The organism associated with the cases was of the El Tor type and in view of the opinion widely held that this form does not cause cholera and that its presence does not justify the application of quarantine measures the interpretation of the occurrence in the Celebes presents some difficulty.

Singapore Island. A certain amount of cholera occurred annually in most years up to 1920 with a maximum of 737 deaths in 1902. Since then,

with the exception of 14 deaths in 1927 and 8 in 1928, the Island has been free from the disease. (Records are not available for the war years.)

Japan. Prior to the Second World War cholera had practically disappeared from the country although in the earlier part of the century epidemics had been frequent and often severe, with occasional years of freedom. Outbreaks were attributed to fresh importations of infection resulting in primary occurrence in seaports with subsequent dissemination by small coastal craft. Peak incidence was usually in August and September, the epidemics dying away in October and November and ceasing in December. A severe epidemic took place in 1946 due to infection carried by repatriation ships from China and other parts of the Far East.

Formosa. Although severe epidemics had occurred at intervals in the years up to 1920 with periods of complete freedom from cholera incidence was negligible from 1923 to 1943. Severe outbreaks again occurred in 1943 and 1946 owing to importation under war conditions.

Ceylon. In spite of its proximity to India and the continuous traffic which takes place between the two countries Ceylon has never suffered from severe epidemics although importation of infection has been frequent and limited outbreaks have occurred, generally after high incidence in India. From 1947 onwards incidence has been negligible.

Cholera in the Asiatic Mainland. A table showing the world cholera mortality rates for the period 1948–52 indicates the extent to which in these post-war years cholera was largely confined to the Asiatic mainland. Of world deaths 79 per cent. occurred in India, 19 per cent. in Pakistan and 1·5 per cent. in Burma, those three countries being thus responsible for 99·5 per cent. of total cholera deaths in the period. The highest incidence was still in East and West Bengal. Incidence in the several mainland areas is summarized.

China. Reliable statistics of the incidence of cholera in China have never been available owing to the inadequacy of the arrangements for reporting disease and such figures as exist only indicate the relative magnitude of prevalence from year to year and the seasonal variations. In the period under review epidemics occurred in 1926, 1932, 1937, 1942 and 1946. From 1937 onwards, owing to war conditions, the disease was widespread and persistent but after 1948 there was a marked decrease if not disappearance. Since statistics were collected no year until 1947 was free from cholera, some part of China always being infected, but prolonged persistence in any one part of the country was not shown. This would suggest that cholera is not truly endemic. It would appear likely that most of the major epidemics in China have been due to importation of infection either from abroad or from areas in the country where conditions of "temporary endemicity" have been established. The absence of cholera in 1949–50 supports this contention that the disease is not endemic. The areas of greatest tendency for persistence appear to be the delta of the Si-kiang river in the southern provinces of Kwang-tung and Kwang-si and the deltaic regions westward to Yun-nan, and northwards along the coast into Fu-kien province. A minor area of persistence has been observed in Hu-nan in a locality on the Yuan river. The deltaic areas of the Yangtse river seem to be less favourable to persistence than the Si-kiang delta. A summary is given of the successive epidemics in the period up to the severe and widespread outbreaks of 1946 which are attributed to the return of displaced persons after the war and to troop movements and repatriation of Japanese internees. After 1948 no cholera deaths were reported.

Thailand. A characteristic form of cholera incidence was noted. After introduction of infection the disease has shown periods of 3 to 5 years of

epidemic prevalence, alternating with interepidemic periods of similar length during which only odd cases occurred. The last such epidemic wave lasted from 1943 to 1947 and there has been no outbreak since. Cholera is not endemic in Thailand.

Indo China. Incidence here has been of somewhat similar character to that in Thailand from which infection is usually derived but outbreaks tend to continue for a longer series of years. Cholera was severe from 1926 to 1931 and again from 1937 to 1939. Figures for the war period are not available but the disease was prevalent up to 1948. Subsequently it has been absent.

Burma. Since 1900 no year has been free from cholera. Although contiguous to India, Burma is not subject to import of infection by land routes as there is no railway communication or major highway between the two countries. There is, however, a continuous risk of importation by sea from the highly infected port of Calcutta and this has been considered to be an important factor in maintaining infection. Although the endemic status of Burma has been somewhat in dispute Swaroop and Pollitzer from the study of the cholera mortality figures for individual districts conclude that there is a focus of cholera endemicity within the Irrawaddy delta in the low-lying districts of Myaungmya, Pyapon and Ma-ubin. The adjoining districts of Rangoon, Hanthuwaddy, Insein and Bassein also show a considerable degree of persistence. A minor degree of persistence was noted in the Thaton districts in the Salween delta. Peak incidence in Lower Burma is in April, May and June and in Upper Burma in August, September and October.

Pakistan. As Pakistan was only separated from India in 1947 the combined figures of cholera deaths for India and Pakistan for 1900–1952 are included in one table. Separate figures for Pakistan are available for 1947–52 and show the continuous incidence of cholera in East Bengal throughout the period, this area belonging to the major recognized endemic zone. Considerable outbreaks occurred in 1947–48 in West Punjab and spread to the North-West Frontier Province owing to large-scale movements of refugees between India and Pakistan after the partition.

India. Figure 5 shows the annual cholera death rate per 100,000 over the period 1877 to 1952. There was a heavy but varying incidence year to year with a maximum of 805,698 deaths in 1900. The annual figure was frequently of the order of 200,000 to 300,000 deaths. A comparatively low incidence was noted in 1932 and 1933, the figures for these years being 66,137 and 68,139 deaths, respectively. The highest recent mortality was 459,930 in 1943, but in 1951 and 1952 the figure approximated only about 60,000. While figure 5 would suggest a long-term decrease in incidence of cholera in India with decreasing magnitude of the successive epidemics from the highest peak year up to 1938 the severity of the epidemic of 1943 and its continuance at high level through a 5-year period leaves doubt as to whether conditions for control have improved. The relationship of epidemic prevalence to fairs and festivals, especially in Uttar Pradesh (United Provinces) is shown and commented on. The greater bulk of the reported cholera deaths occurred in the major endemic home of the disease, namely, in Bengal, Bihar, Orissa, Assam and the United Provinces, Madras contributing the next largest total. Over the 40-year period from 1910 to 1949 the percentages of the total cholera deaths in the several areas were: Bengal 29, Bihar and Orissa 26, United Provinces 17, and Madras 14. These areas were thus responsible for 86 per cent. of the cholera deaths in British India.

A summary is given of the incidence of cholera in India from 1923

onwards with comments on factors which may have affected prevalence. This should be consulted in the original by those specially interested. Experience in the period emphasizes that Bengal and the adjoining provinces continue to be the major endemic world centre of cholera, the focus of highest endemicity being in south Bengal in the delta of the Ganges and the Brahmaputra. A special method was employed in India for comparison of the level of endemicity of cholera in individual districts. This consisted of calculating the average cholera-mortality rates for the 15 years in the period 1901 to 1945 in which the lowest incidence was shown. Calculated by this method the highest rates, 1·0 per 1,000 or over, were shown by Howrah, 24-Parganas, Bakarganj and Dacca (the two latter being in East Pakistan). The contiguous districts of Khulna, Tippera, Faridpur and Calcutta were next in order with rates of 0·99, 0·99, 0·97 and 9·2, respectively, and the coastal districts of Orissa State, *i.e.*, Balasore and Cuttack, followed with figures of 0·91 and 0·81. By the examination of the figures for smaller areas, the *thanas*, which are subdivisions of the districts, it was possible to define special areas which could be considered to be major foci of persistence. One such focus was detected at the confluence of three rivers, the Hoogly, the Rupnarayan and the Damodar, situated about 40 miles south-west of Calcutta. Its proximity to the city and the persistence of cholera in it at all times are a continuous threat to Calcutta which it can reinfect year by year. The cholera mortality rate for Bengal undoubtedly shows a general downward tendency in the last 50 years although this tendency was upset in the famine years 1941–43 when there was a virtual temporary breakdown of control measures. A comparison of the mortality figures of the districts of Bengal in the two 10-year periods 1901–10 and 1934–43 shows decreases in incidence in the several districts which vary from 20·1 per cent. to 87·5 per cent. with an average of 53·5 per cent. Incidence in the quinquennium 1946–50 was only 20 per cent. of that of 1891–5. The decrease appears to have been most marked in the zones which are of lower endemic status.

Cholera in Asiatic seaports. The incidence of cholera in seaports during the period 1926 to 1952 was negligible except in certain ports in India and Pakistan. When the average annual cholera case-rates per 100,000 of population for the 5 years of lowest prevalence during the period 1926–40 were calculated the following rates were found for ports in India and Burma: Calcutta 89·6 per cent., Chittagong 20·2, Bassein 10·0, Madras 2·3, Rangoon 1·2 and Bombay 0·03. Outside India, Pakistan and Burma rates were: Swatow 0·2, Bangkok 0·1, Shanghai 0·03, Canton 0·02. Calcutta, the most heavily infected port, has not, during a period of over a century, been free from cholera in any year and has recorded an average annual total of 3,000 to 4,000 cases. Even in very recent years, 1948 and 1950, totals of 7,924 and 9,529 cases were reached. The period of seasonal rise is the same in Calcutta, Chittagong, Bassein and Bangkok, namely, the months of May, June and July. The winter rise is negligible. In Rangoon cholera is more spread out and cases mainly occur in the first half of the year. Madras shows two peaks, one in July and August and another in the winter months at the time of the north-eastern monsoon. Peak incidence in Bombay is during the south-west monsoon. *John Taylor*

Chakraborty, N. **Certain Observations on Venous Pressure and Circulation Time in Cholera.** *Calcutta Med. J.* 1954, Oct., v. 51, No. 10, 336–40.

Observations were made on the venous pressure and the circulation time in 60 cases of cholera under treatment in a Calcutta hospital during

epidemic periods between 1951 and 1954. Of the 60 patients 6 died; all were given intravenous saline as the main treatment. The patients were mostly adults. In 35 cases the systolic blood pressure and in 46 the diastolic was entered as nil; in no case was the systolic above 94 mm. Hg.

The blood specific gravity was noted in 31 cases; it was below 1065 in 2 cases, between 1065 and 1069 in 15, and between 1070 and 1072 in 14. All patients were dehydrated.

The circulation time was estimated by the injection of 5 ml. of 20 per cent. dehydrocholine rapidly into a vein in the antecubital fossa and the time taken up to the moment a bitter taste was first noted in the mouth. The normal time is given as 9 to 18 seconds with a mean of 13·5 seconds. The times noted in the cholera patients before saline was given were: less than 9 seconds, 1 case; between 9 and 18, 13 cases; between 18·1 and 20, 17 cases; between 20·1 and 30, 22 cases; between 30·1 and 40, 5 cases; longer than 40 seconds, 2 cases; average, 22·1 seconds.

The test was repeated after saline had been given, usually 3 pints; there was no change in one case and in 2 the time increased. Falls in the circulation time were recorded in the remaining 57 cases as follows: a fall of 5 seconds or less in 24 cases; a fall of 5·1 to 7 seconds in 18 cases; a fall of 7·1 to 10 seconds in 11 cases; a fall of 10·1 to 15 seconds in 2 cases; a fall of 15·1 to 20 seconds in 3 cases; average, 6·3 seconds.

At the time of discharge, the circulation time was between 10 and 18 seconds in 19 cases and in 2 it was still above 18, namely 24 and 26 seconds.

The venous pressure was taken in 48 cases by the introduction of a maximum bore intravenous needle, connected to a spinal manometer by a fine rubber tube into a vein in the antecubital fossa. The normal was said to be 2 to 10 centimetres of water. The pressure was below 2 cm. in 4 cases, between 2 and 10 cm. in 35 and above 10 cm. in 9, average 7·5 cm., before the administration of saline; after saline it was increased in all cases, by 1 to 5 cm. in 35 cases, by 5·1 to 7 cm. in 9 and by 7·1 to 10 cm. in 4 cases, average 4 cm. Except in 4 cases the venous pressure was within normal limits or only slightly increased when the circulation time was above normal. At the time of discharge, when the patients were clinically cured, the venous pressure was between 7 and 10 cm. in 6 cases, above 10 cm. in 12. Practically all registered a very slight further rise.

L. E. Napier

De, S. N., Sengupta, K. P. & Ganguli, N. C. **Histochemical Observations on the Suprarenal Glands in Cholera.** *Lancet.* 1955, May 21, 1043–5, 10 figs.

Histochemical examinations were made in paired suprarenals from 11 bacteriologically positive cases of cholera fatal within 48 hours " after onset in the stage of shock ". Paired glands from 10 patients dying from accidents within 15 minutes were compared as controls. Autopsies were performed 24–48 hours after death on bodies kept in the cold chamber. Frozen sections were examined from 5 blocks of each gland. Neutral fat was stained with Sudan IV; cholesterol was identified with digitonin by polarized light, and ketosteroids with 2:4 dinitrophenylhydrazine.

Depletion of neutral fat from all zones was found in 4 cases of cholera and patchy depletion in 6. In all 10 there was well marked loss of cholesterol and ketosteroids. One case showed no depletion of neutral fat but cholesterol was confined to the zona glomerulosa.

The abundant neutral fat in the controls appeared as large sudanophil globules; in the cholera cases as small granules.

The authors point out that depletion of lipoid material from the suprarenal cortex may be associated with increased liberation of cortical hormone. They believe that the suprarenals play an active part in cholera through such enhanced synthesis. Observed changes in the blood—excessive leucocytosis with neutrophilia, lymphopenia and eosinopenia—support this contention. The absence of necrosis or haemorrhage in the glands of the cholera patients suggests a non-specific process. Further work is required to determine the functional state of the suprarenal-pituitary system in cholera. *B. G. Maegraith*

Narayana Rao, Y. S., Balasubramaniam, C. S. & Ramachandra Rao, A. **A Comparative Study of Phthalylsulphathiazol, Chloromycetin and Aureomycin in the Treatment of Cholera.** *Indian Med. Gaz.* 1954, Apr., v. 89, No. 4, 207–11.

A clinical trial was undertaken to test the efficacy of chloramphenicol and aureomycin in the treatment of cholera, in Madras city during an epidemic. Alternate patients diagnosed clinically as cholera and within the age-group 12 to 40 years were taken for antibiotic treatment, the others to act as controls. In each case a bacteriological diagnosis was made on specimens obtained by the passing of a rubber catheter into the rectum; if 3 consecutive stools were negative, the particular case was excluded from the series. [But the author does not state how many such cases there were, and it is a coincidence—not commented upon—that the number of test and control cases happened to be the same in each series.]

The patients of one series received 500 mgm. of chloramphenicol in capsules every 4 hours up to a total of 9 gm. and patients under 20 years of age a total of 6·75 gm.; controls received a corresponding number of keratin-coated potassium permanganate pills.

The adult patients of the second series received 500 mgm. of aureomycin every 6 hours up to a total of 6 gm. [presumably] and those under 20 years a total of 4·5 gm., or Thalazole [Phthalylsulphathiazole BPC] 4 gm. immediately and 2 gm. every 8 hours up to a total of 14 gm.

The antibiotic was given by mouth and repeated if rejected by vomiting.

Every patient was also given glucose (1 per cent.)—saline (1 per cent.) intravenously, as indicated by the clinical condition.

In the first series there were 57 patients on chloramphenicol and 57 controls who had no specific treatment; there were 4 deaths (7 per cent.) among the former and 7 deaths (12·5 per cent.) among the controls. *Vibrio cholerae* persisted in the stools on an average for 2·8 days in the former and for 3·8 days in the controls.

In the second series there were 40 patients on aureomycin and 40 controls on Thalazole; there was 1 death (2·5 per cent.) in the former series and 2 (5 per cent.) in the latter. *Vibrio cholerae* persisted in the stools at an average for 1·9 days in the former cases and in 4 days in the latter. This second series was in progress as the epidemic was waning.

The cases were classified as mild, moderate or severe, but this classification was made after treatment and was based on the amount of saline that it was necessary to administer; on this basis there were 5 severe cases in each of the 2 antibiotic series, 13 in the controls in the first series and 8 in the Thalazole controls of the second series. [There are obvious fallacies in this *post hoc* method of classifying the cases.]

The clinical improvement in the patients treated with aureomycin was most striking.

The authors point out that there are no statistically significant differences between the results obtained in the various groups, but consider that they suggest that aureomycin may be of some specific value in the treatment of cholera. [See also this *Bulletin*, 1953, v. 50, 810; 1954, v. 51, 692, 918.]

L. E. Napier

AMOEBIASIS AND INTESTINAL PROTOZOAL INFECTIONS

In this section abstracts are arranged as far as possible in the following order:—epidemiology, aetiology, pathology, diagnosis, clinical findings, treatment, control.

Offutt, A. C., Poole, B. A. & Fassnacht, G. G. **A Water-Borne Outbreak of Amebiasis.** *Amer. J. Pub. Health.* 1955, Apr., v. 45, No. 4, 486–91, 2 figs.

Engineering studies designed to discover the possible cause of an outbreak of amoebiasis which occurred in 1953 in South Bend, Indiana, have been reported in a paper [this *Bulletin*, 1955, v. 52, 365] in which it was also noted that "official statements have not yet been released". The present paper gives medical and epidemiological particulars of the outbreak, largely abstracted from preliminary drafts of a paper which is being prepared by the U.S. Public Health Service at Atlanta, Ga., and it also refers to the paper describing the engineering aspects of the investigation.

The existence of an outbreak was first realized in 1953. Enquiry revealed that there had been 3 cases in 1951 and 4 in 1952. In 1953 there were 4 cases from January to the middle of March, 18 more by 1st May and an additional 23 by the end of May. A good account is given of the local and inter-State investigations that were carried out. Attention was focussed on enquiry into the conditions existing in a local factory because a high proportion of those affected were employees from that factory. The sanitary engineering investigation, which has been described and is here recapitulated, was difficult and extensive but ultimately revealed a leak in the sewerage system which was probably the cause of infection of the water supply.

M. E. Delafield

Fremming, B. D., Vogel, F. S., Benson, R. E. & Young, R. J. **A Fatal Case of Amebiasis with Liver Abscesses and Ulcerative Colitis in a Chimpanzee.** *J. Amer. Vet. Med. Ass.* 1955, May, v. 126, No. 938, 406–7, 2 figs.

Capocaccia, L. & Cao-Pinna, M. Influenza della polvere di riso sottoposta a diverse temperature sulle colture di *Entamoeba histolytica*. [**Effect of Rice Powder subjected to different Temperatures upon Cultures of** *Entamoeba histolytica*] *Arch. Ital. Sci. Med. Trop. e Parassit.* 1954, May, v. 35, No. 5, 215–22, 1 chart. English summary.

Since the discovery, in 1926, that starch promoted the growth of *Entamoeba histolytica* in culture, sterilized rice powder has been an

essential ingredient of all media used for this purpose. In the present paper the authors describe the results of experiments on the effect upon the amoebic cultures of rice powder subjected to different temperatures before addition to the medium. For this purpose 40 mgm. amounts of Difco rice powder were added to 3 media (Boeck and Drbohlav's, Balamuth and Sandsa's and Difco) after having been heated for half an hour at 50°, 100°, 120°, 140°, 160° and 200°C., and without previous heating. The results were assessed by counting the amoebae in the cultures every 12 hours, after 24 hours' and up to 72 hours' cultivation. The best growth was obtained with rice powder heated between 120° and 140°C.

In discussing the results, the authors suggest that at these temperatures either a growth-inhibiting factor is destroyed or a growth-promoting one is activated in the rice powder, or its assimilation by the amoebae is facilitated.

C. A. Hoare

Edelman, M. H. & Spingarn, C. L. **The Relation of the Number of Cysts in the Stool Inoculum to the Incidence of Positive Cultures of** *Endamoeba histolytica*. *Amer. J. Trop. Med. & Hyg.* 1954, Nov., v. 3, No. 6, 995–8.

The authors have previously shown that the addition to the media of antibiotics (streptomycin and penicillin) promoted the cultivation of *Entamoeba histolytica* from stools containing cysts, though in about one-third of the cases no growth was obtained [this *Bulletin*, 1953, v. 50, 27]. Since insufficient numbers of cysts in the inoculum might have been responsible for this failure, experiments were carried out to determine the rôle played by this factor.

For this purpose cultures were started (1) from 27 patients whose stools contained cysts of *E. histolytica* and (2) from 50 patients in whose stools no cysts or trophozoites were detected. In each case 1 gm. of faeces was emulsified in 5 cc. saline, in which the average number of cysts was calculated on the basis of counts made in test preparations of the suspension, and 0·1 cc. of the emulsion containing varying numbers of cysts was inoculated in diphasic medium (Difco slant covered with serum-saline), in 3 groups: (1) with the addition of streptomycin or (2) penicillin, and (3) without antibiotics.

The results showed that there was a direct relationship between the number of cysts of *E. histolytica* inoculated and the proportion of cultures in which growth of trophozoites was obtained. The cultures were always positive when 15 or more cysts had been present in the test preparation. In general, the addition of antibiotics was found to favour cultivation even from specimens containing scanty cysts, while a single positive culture was obtained out of 50 stools in which no cysts were detectable microscopically.

C. A. Hoare

Hervé, A. & Piganiol, G. Les aspects chirurgicaux de l'amibiase (complications hépatiques exceptées). [**Surgical Aspects of Amoebiasis other than Hepatic Complications**] *Méd. Trop.* Marseilles. 1955, Jan.–Feb., v. 15, No. 1, 5–27.

de Mello, J. P. & de Mello, Ruby N. **The Treatment of Acute and Chronic Amoebiasis. "Camoform (PAA-701)".** *East African Med. J.* 1955, Feb., v. 32, No. 2, 47–50, 1 fig.

Camoform (PAA 701, or diallyl-diethylamino-methyl phenol dihydrochloride) has been shown to be amoebicidal *in vitro*. When given orally 70–80 per cent. is absorbed, and 0·5 per cent. reappears in the urine. The drug is excreted slowly over a period of 3 to 6 weeks; the initial plasma concentration falls substantially during the first 3 days, but thereafter remains at an appreciable level for at least 3 weeks; this suggests that there is localization of the compound in the tissues. Camoform could therefore be effective against both intestinal and extra-intestinal amoebiasis.

One hundred and fifteen patients, mostly East Africans, were found to be suffering from active amoebiasis. In all but 20 of them the diagnosis was confirmed by recovery of the parasite. All were treated with Camoform. The dosage for adults was 1·5 gm. on the 1st day, 1·25 gm. on the 2nd and 3rd days, and 1·0 gm. on the 4th day; children had 0·75 to 1·25 gm. daily for 3 days, according to age. Some patients under detention had more substantial dosage; no serious toxic side-effects were observed. In those cases in whom daily stool examinations were possible it was noted that parasites vanished from the stools by the 3rd day; symptoms and signs had largely gone by the 5th day. Of 97 patients re-examined later [the time and the number of re-examinations are not stated] 91 were free of parasites and were clinically cured; 6 children died of "concomitant infection". It is claimed that in addition to its being an effective therapeutic and sterilizing agent for intestinal and extra-intestinal amoebiasis, Camoform may prove to be a good prophylactic against amoebiasis.

[Before accepting yet another compound as the answer to the therapy of amoebiasis, more detailed and much more thorough and prolonged observation is highly desirable.] *A. R. D. Adams*

Chang, S. L. & Baxter, Margery. **Studies on Destruction of Cysts of *Endamoeba histolytica*. I. Establishment of the Order of Reaction in Destruction of Cysts of *E. histolytica* by Elemental Iodine and Silver Nitrate.** *Amer. J. Hyg.* 1955, Jan., v. 61, No. 1, 121–32, 2 figs. [17 refs.]

Chang, S. L., Baxter, Margery & Eisner, Laurel. **Studies on Destruction of Cysts of *Endamoeba histolytica*. II. Dynamics of Destruction of Cysts of *E. histolytica* in Water by Tri-Iodide Ion.** *Amer. J. Hyg.* 1955, Jan., v. 61, No. 1, 133–41, 4 figs. [10 refs.]

One drawback in cysticidal studies is the difficulty encountered in determining the rate of destruction. The usual culture method of testing the survival of exposed cysts can tell only whether or not the cysts are all killed, because the presence of trophozoites, which constitutes a positive culture, may result from the survival of one, few or more cysts.

These papers set out the results of a study made to determine the order of reaction in the destruction of cysts of *Entamoeba histolytica* in water by iodine and silver nitrate.

The destruction of amoebic cysts by both iodine and silver nitrate followed a constant rate against contact time and the rate of destruction was independent of the initial cyst concentration. The cysticidal effect of silver nitrate was poor compared with iodine, probably owing to the poor penetrating power of the silver ion into the cysts.

Further work with iodine revealed that the tri-iodide ion is much inferior to iodine in its cysticidal effect and this is attributed to the negative charge that the ion bears. It would therefore be better in practice that when elemental iodine is to be used as a disinfectant, it should be prepared in solutions containing as little iodide ion as possible. *E. Windle Taylor*

MAEGRAITH, B. G. & HARINASUTA, C. **Experimental Amoebic Infection of the Liver in Guinea-Pigs. I.—Infection via the Mesenteric Vein and via the Portal Vein.** *Ann. Trop. Med. & Parasit.* 1954, Dec., v. 48, No. 4, 421–33, 4 figs. on pl. & 2 text figs. [18 refs.] **II.—Abscess Formation in Animals with Persistent Intestinal Lesions.** *Ibid.*, 434–41, 6 figs. on 2 pls.

In the case of human amoebiasis it is generally thought that infection of the liver arises as the result of metastasis from the intestinal lesions, whence the amoebae are carried via the portal circulation. However, up to the present this hypothesis has not been proved. In these two papers the authors describe the results of experiments, the object of which was to ascertain whether hepatic amoebiasis could be produced in guineapigs by injection of *Entamoeba histolytica* into the portal circulation.

I. In the first paper an account is given of experiments on normal guineapigs injected with cultures of *E. histolytica* (1) into the mesenteric vein lying between the ileum and the caecum, and (2) into the right branch of the portal vein. In order to reduce the effect of the concomitant bacteria on the course of infection, the bacterial infection was usually controlled by intramuscular injection of streptomycin + penicillin into the host before inoculation. The guineapigs were sacrificed at intervals from 2 to 10 days after inoculation, when the liver was examined, and those parts which showed signs of lesions were fixed for histological examination of sections, while smears were inspected for the presence of amoebae, and some of this material was inoculated into culture media.

The results of these experiments were as follows. Intramesenteric inoculation of *E. histolytica* produced scattered lesions in the liver, in which amoebae were demonstrable with difficulty, though they could usually be recovered in culture during the first 48 hours. The lesions were represented by small circumscribed necrotic areas with cellular reactions, sometimes coalescing to form larger lesions. Since the injection of bacteria alone by the same route produced only minute temporary necrotic reactions, it is assumed that the amoebae themselves were responsible for the pathological changes in the liver. Intraportal inoculation of *E. histolytica* proved to be a better method for producing infection in the liver, in which lesions—appearing in the right lobe exclusively—were much more extensive and resulted in less toxaemia than those produced through the mesenteric vein. Destruction of the liver cells was progressive, giving rise to abscesses by the 48th–72nd hours around the initial foci of necrosis, which were associated with the small radicles of the portal tracts. However, here again, healing and fibrosis of the lesions began after 72 hours. Up to that time *E. histolytica* could be found in most lesions.

II. Having shown that *E. histolytica* was capable of setting up a temporary infection in the liver of normal guineapigs, the authors turned to an investigation of the conditions promoting a more permanent establishment of amoebic infection in the liver of these animals. On analogy with human infections it was thought that the existence of a persistent intestinal infection might be a favourable factor. In accordance with this view, chronic intestinal lesions

were first induced in guineapigs by intracaecal inoculations (one or two) of amoebic cultures followed by treatment with Diodoquin [di-iodohydroxyquinoline] [this *Bulletin*, 1954, v. 51, 587], after which cultures were injected into the portal vein. This procedure resulted in the production of large confluent liver abscesses, which progressed and persisted up to 12 days, during which period *E. histolytica* was detectable directly and by culture. It is concluded that the severity and duration of the lesions in these experiments were connected with the persistence of an intestinal amoebic infection in the animals.

The papers are illustrated by a series of photomicrographs depicting the histopathogical changes described. *C. A. Hoare*

Bray, R. S. **On the Coccidia of the Mongoose.** *Ann. Trop. Med. & Parasit.* 1954, Dec., v. 48, No. 4, 405–15, 4 figs. [24 refs.]

A description is given of two new coccidia recovered from mongooses, *Helogale undulata rufula*, captured in north Kenya. One of the parasites, *Isospora garnhami* sp. n. which inhabits the epithelial cells of the ileum and colon of the host, is characterized by large ellipsoidal oöcysts (25·8–32·4 × 21·6–28·2μ) devoid of a residual body, while the rounded sporocysts (11·8–15·2 × 10·6–12·4μ) contain a large residue. The other parasite, *I. hoarei* sp. n., develops in the epithelial cells of the duodenum and jejunum, producing small ellipsoidal oöcysts (16·2–19·4 × 12·8–16·8μ) with almost spherical sporocysts (8·6–9·8 × 8·0–9·2μ): as in the larger species, there is a bulky sporocystic residue, but none in the oöcysts.

The stages of development of these coccidia are illustrated in a series of figures. *C. A. Hoare*

RELAPSING FEVER AND OTHER SPIROCHAETOSES

Cambournac, F. J. C., de Almeida Roque, R. & Rés, J. F. Relatório sobre febre recorrente no continente Português. [**Relapsing Fever in Portugal**] *Bol. Serviços de Saúde Pública.* Lisbon. [1954?], v. 1, Nos. 1/2 & 3/4, 9–47; 193–253, 14 charts, 12 figs. & 2 maps. [15 refs.] English summary.

The occurrence in August 1949 of 6 cases of relapsing fever in the municipality of Serpa resulted in an application to the Director of Public Health to institute an enquiry into the existence and prevalence of this disease in Portugal.

A reply was received to the effect that relapsing fever has been well known to the Health Authorities since 1922 and that *Ornithodorus erraticus* was the vector and *Spirochaeta hispanica* the organism concerned. A Commission was, however, appointed and joined the Service for Prevention of Infective and Social Diseases. A questionary was drawn up and sent to 7 districts.

Between the middle of 1949 and the end of 1952, 55 cases had been recorded, 53 confirmed by direct examination and 2 by animal inoculation into guineapigs: 19 in 1949; 23 in 1950; 8 in 1951 and 5 in 1952.

Brief notes are given of each of the 55 patients; both sexes were affected and their ages ranged between 2 and 68 years. The incubation period varied from 2 to 7 days. From each of 24 patients blood was inoculated

into guineapigs and positive results were obtained in 18 in 2–8 days (usually 2) and the parasitaemia persisted for 9 to 39 days, the average being 18 days. Mice, after inoculation, showed the parasites in 1–6 days and continued to do so for 16 to 19 days; rabbits showed the infection within 3 days of inoculation and parasitaemia persisted for 6 to 13 days; puppies 2 months old were positive on the 2nd day, negative on the 3rd and 4th days, positive again on the 5th day.

After remarking on the finding of *O. erraticus* infected in nature, the authors give some notes on the biology of this vector and, in places where it is not found, *Rhipicephalus sanguineus* may take its place.

There follows a section on epidemiological considerations. Sadi de Buen in 1926 stated that the normal animal host was the pig [see this *Bulletin*, 1926, v. 23, 590] and that *O. erraticus* acquired the infection by feeding on this animal and thence transferred the infection to man. In their attempts to infect pigs the authors were successful with 6 out of 8.

The incidence in successive years has already been stated; by age, 5 were under 5 years, 6 were in the 6–10-year group; 7 in the 10–15 group; 6 in the 15–20 group, 17 in their 3rd decade and 14 were above this age; 30 of the 55 worked with pigs, either as day-labourers or as swineherds; 28 were in the municipality of Maurão and 10 in Serpa. Infections were most common in July (15), August (14) and September (12), *i.e.*, 41 of the 55 occurred in the 3rd quarter of the year. Line maps indicate the districts infected.

For dealing with the vector the authors propose the use of DDT and benzene hexachloride and, for treatment of the patients, penicillin. Notes are given of its use in 6 patients and also of other antibiotics, but the results were far from conclusive, though aureomycin and oxytetracycline proved better than dihydrostreptomycin or chloramphenicol. *H. Harold Scott*

Özsan, K. & Akyay, N. La fièvre récurrente en Türquie. Presence dans le Sud (frontière Turco-Syrienne) d'*Ornithodoros erraticus* infecté d'un spirochéte du groupe Crocidure. [**Relapsing Fever in Turkey. Presence in South Turkey of** *Ornithodorus erraticus* **Infected with a Spirochaete of the** *crocidurae* **Group**] *Türk Ijiyen ve Tecrübî Biyoloji Dergisi.* Ankara. 1954, v. 14, No. 3, 37–9. [Fuller version in Turkish 34–6.]

Large outbreaks of louse-borne relapsing fever have occurred in Turkey since the beginning of the century, notably before, during and after the First World War and in 1947.

Apart from these major epidemics, relapsing fever has continued to occur in Turkey, particularly in the East and South-East, but solely in the sporadic form characteristic of the tick-borne type.

In June 1953 the authors began a systematic search for tick vectors in the Akçakale region on the Syrian border (Urfa district) where a small outbreak of 34 cases had occurred at the end of 1949. Survey of houses and stables in villages failed to reveal the presence of domestic ticks, but several specimens of the small variety of *Ornithodorus* were collected in wild-rodent burrows. They were brought alive to Ankara and allowed to bite new-born rabbits, which Baltazard *et al.* had shown to be the most sensitive hosts in the laboratory [this *Bulletin*, 1949, v. 46, 43].

Of 5 lots thus tested, only 1 (containing 11 *Ornithodorus*) from the village of Telhalip was found to be infected. The bitten rabbit died in 8 days with jaundice and having many spirochaetes in the blood.

Unfortunately the strain was lost by death of the animals and only 3 ticks had survived from the original lot, but 6 weeks later they were

allowed to bite a fresh new-born rabbit, and this animal became infected in 7 days. Passage to 4 white rats and then to 2 guineapigs resulted in a very slight infection in the rats and no detectable infection in the guineapigs. Further passages to new-born or young rabbits and to rats were made either with blood rich in spirochaetes or with the brain of a rat 3 months after it had been infected: there always resulted (1) intense and fatal infection in the new-born rabbits, (2) intense relapsing infection, with or without death in rabbits more than a week old and (3) slight infection in adult rats.

The ticks were identified by Dr. Baltazard as belonging to the dwarf variety of *O. erraticus*. Since the strain of spirochaete isolated was fatal to new-born rabbits, but did not appear to infect adult guineapigs, it was considered to belong to the *crocidurae* group of Baltazard's classification [this *Bulletin*, 1954, v. 51, 931; 1955, v. 52, 454] and this identification was confirmed by Dr. Baltazard.

It is evident that tick-borne relapsing fever is present in Turkey and the authors note the epidemiological importance of pursuing these studies in other foci. *H. J. O'D. Burke-Gaffney*

Horrenberger, R. Transmission expérimentale de *Spirochaeta hispanica* de Buen, 1926, par morsure de rat. [**The Experimental Transmission of *Spirochaeta hispanica* by Rat Bites**] *Arch. Inst. Pasteur d'Algérie*. 1955, Mar., v. 33, No. 1, 1–9.

The almost simultaneous appearance and disappearance of *S. hispanica* and *Spirillum minus* in the brains of sewer rats in Algiers [this *Bulletin*, 1954, v. 51, 270, 931], suggested the possibility that *S. hispanica* might also be transmitted by the bites of infected rats. Accordingly a series of experiments was made in which rats infected with *S. hispanica* were induced to bite both normal white rats and guineapigs. Subsequently the mouth of each rat which had bitten another animal was washed out with saline and the fluid containing saliva inoculated into a second series of rats and guineapigs, and also examined microscopically to make sure that the saliva did not contain any blood from possible injury to the gums or other mucosa.

The results show that out of 32 infected rats 16 (50 per cent.) inflicted one or more infective bites, while the other 16 failed to produce infection. The proportion of infections following the inoculation of saliva was much higher, 21 out of 29 (72·4 per cent.), and there was also a higher percentage of positive results after a second bite. Very young rats did not seem to become infective and also their saliva remained free from infection even though their blood contained numerous spirochaetes.

The maintenance of the strain for several passages in rats seemed to facilitate its transmission by the bites of infected rats. The microscopical examination of the saliva was uniformly negative for spirochaetes except in one case when two immobile organisms were seen. The infections in guineapigs resulting either from bites or the inoculation of saliva have a much longer incubation period than usual, sometimes up to 22 days, and the first attack is short and intense followed one or two days later (during which spirochaetes do not disappear from the blood) by a severe first relapse which is prolonged and dominates the clinical course of the infection. This type of infection differs considerably from that following the ordinary subcutaneous or intraperitoneal inoculation of infected blood, in which the incubation period is short, the original attack is usually the most severe,

and the relapses are separated by short intervals during which the blood is negative for spirochaetes. On the contrary the infection produced in white rats either by bite or inoculation of saliva is very slight, with few spirochaetes in the blood, whereas after the inoculation of infected blood the attack is rapid and massive with very large numbers of spirochaetes in the circulation.

It is evident that the mechanical transmission of *S. hispanica* by the bites of infected rats provides a method of maintaining the infection in sewer rats in the absence of ticks or other arthropod carriers.

Edward Hindle

YAWS AND OTHER TREPONEMATOSES

South Pacific Commission. Noumea, New Caledonia. H-10 Project. **Yaws** [Published by the Health Section; Data assembled by G. Loison]. *Technical Information Circular No. 6.* 1954, June, 12 mimeographed pp.

Yaws is still an important cause of morbidity in most of the islands of the South Pacific. In this circular is set out what is known about the state of the disease in each territory and the results of attempts made in the past to eradicate it. Relapses following treatment by arsenical drugs or bismuth were common. In 1955 territorial administrations will receive assistance from the World Health Organization in their yaws control campaigns under the H-10 project which also seeks to ascertain the optimal dosage of a repository penicillin. *Frederick J. Wright*

LEPROSY

In this section abstracts are arranged as far as possible in the following order:—epidemiology, aetiology, pathology, diagnosis, clinical findings, treatment, control.

Avilés Nugué, F. & Blum Gutiérrez, E. Acerca de 60 casos de lepra estudiados en el Instituto Nacional de Higiene. [**Observations on 60 Leprosy Cases Studied in the National Institute of Hygiene**] *Rev. Ecuatoriana de Hig. y Med. Trop.* Guayaquil. 1954, July–Sept., v. 11, No. 3, 99–107.

A description is given of 60 patients, 36 of whom were lepromatous, 22 tuberculoid and 2 indeterminate. The parts of Ecuador from which they came are given. It is acknowledged that no thorough survey of leprosy in the country has yet been made. The fact that 60 per cent. belong to the lepromatous type is considered to be a cause of alarm and a danger of the spread of infection. *Ernest Muir*

Moretti, G. A-t-on découvert un bacille de Hansen cultivable et inoculable? [**Has a Leprosy Bacillus been Discovered which it is possible to Cultivate and Inoculate ?**] *J. Méd. de Bordeaux.* 1955, Apr., v. 132, No. 4, 431–4.

This is a critical examination of the so-called *Mycobacterium marianum*, discovered by Sister Marie-Suzanne [this *Bulletin*, 1953, v. 50, 1150; 1955,

v. 52, 272]. The conclusion is arrived at that it is an acid-fast bacillus; it is not arranged in globi like the leprosy bacillus; it is easily cultivated and inoculated in the rat; it is not pathogenic to guineapigs. On inoculation in the rat it gives a cellular reaction similar to that given by the leprosy bacillus and by several "paratuberculous" bacilli. It persists for a long time in the bodies of certain insects. When an extract of it is made and injected into the skin of leprous patients it gives a different reaction from that given by the leprosy bacillus in the Mitsuda test. It is therefore concluded that it is not the leprosy bacillus but a "paratuberculous" bacillus. *Ernest Muir*

Liban, E., Zuckerman, A. & Sagher, F. **Specific Tissue Alteration in Leprous Skin. VII. Inoculation of *Leishmania tropica* into Leprous Patients.** *Arch. Dermat.* 1955, Apr., v. 71, No. 4, 441–50, 7 figs.

This paper is in continuation of a series [see this *Bulletin*, 1955, v. 52, 273, 274 *bis*] in which the effects of inoculation of lepromatous patients with BCG and *Leishmania tropica* are studied. Out of the 23 lepromatous patients tested 15 had active lesions with bacilli demonstrated, and 8 failed to show bacilli. All but 3 had negative responses to the leishmanin test. All 23 patients were injected intradermally in the deltoid region with a standard dose of a million washed culture leptomonads. All the patients responded clinically to the inoculation in the same way as normal persons, a papule developing after a period of 2 weeks and increasing from 1 to 4 cm. in diameter, ulcerating within 6 to 7 months and scarring by the 7th to 12th month. In 44 biopsies of inoculation lesions, 20 of the 23 patients showed histological lesions identical with specimens from lepromatous leprosy, including foam cells with sudanophilic vacuoles. In 4 specimens there were a few giant cells of the Langhans type scattered among the foam cells. In 7 specimens the foam cells contained Leishman-Donovan bodies often in large numbers. In 5 specimens the general picture was that of tuberculoid granulation tissue as seen in relapsing cutaneous leishmaniasis. This isopathic response is similar to that observed in leprous patients following inoculation of living BCG bacilli. *Ernest Muir*

de Faria, J. L. Revisão dos estudos experimentais sôbre a reação à lepromina relacionados com a natureza desta reação. [**Review of Experimental Studies on the Lepromin Reaction Related to its Nature**] *Rev. Brasilcira Leprologia.* S. Paulo. 1954, June, v. 22, No. 2, 145–56. [59 refs.]

The English summary appended to the paper is as follows:—

"Critical review of the literature on experimental results obtained in the last two decades, which have contributed to the knowledge of the nature and mechanism of Mitsuda's reaction. Simultaneously, obscure problems are listed which require investigation. The following topics are also discussed: substances held as responsible for the Mitsuda's reaction, histopathology of the reaction, comparative histopathology, nature and mechanism of the lepromin reaction. The writer's studies on the lepromin reaction in dogs have shown that in this animal the reaction is due to a natural resistance and is caused by the lipidic fraction of lepromin. In the present state of knowledge it is not possible to say whether or not the Mitsuda's reaction in tuberculoid leprosy cases is due to a natural or acquired (specific or non-specific)

resistance. The writer believes that, in the majority of tuberculoid patients, the resistance is independent of the leprous infection and is present before it."

Kuper, S. W. A. **Tuberculin and Lepromin Sensitivity in the South African Bantu.** A Pilot Survey. *Lancet.* 1955, May 14, 996–1001, 3 figs. [17 refs.]

An investigation was made in 3 groups of South African Bantus to see if there was any coordination between the tuberculin and the lepromin reactions. The 3 groups consisted of 102 patients with leprosy, 57 patients with pulmonary tuberculosis, and 114 healthy controls. Lepromin was injected into the left arm and tuberculin into the right. The results are shown in graphs. The degree of correlation established between tuberculin and lepromin sensitivities was small, and was found only among the patients with pulmonary tuberculosis, the smallest of the 3 groups tested. The tuberculous patients showed a greater degree of sensitivity to lepromin than did the controls, though this might only be a consequence of the former correlation. In lepromatous leprosy a small proportion of patients showed an intense degree of sensitivity to tuberculin; but when these were excluded the two main groups of leprosy patients did not show greater tuberculin sensitivity than the controls.

The conclusion is arrived at that there is no simple and direct relationship between tuberculin and lepromin sensitivities, but that observations in patients with tuberculosis and lepromatous leprosy suggest the existence of a relationship of some kind. *Ernest Muir*

Contreras, F., Terencio, Guillen & Vazquez Contreras. Las reacciones de Hanger, Gross, Cadmio y Formolgelificación en sueros de enfermos de Hansen. [**The Hanger, Gross, Cadmium and Formol-Gel Reactions with the Sera of Leprosy Patients**] *Rev. "Fontilles".* Valencia. 1955, Jan., v. 3, No. 7, 519–26. [10 refs.]

These 4 tests were tried out in 100 leprosy patients, 66 being lepromatous, 12 tuberculoid and 22 uncharacteristic. The technique of each of these tests is described along with the numbers of positive and negative reactions with the 3 forms of leprosy.

The results arrived at show that reactions are stronger in bacteriologically positive, toxic and generalized cases than in the uncharacteristic and tuberculoid ones, and in the latter two they are mostly negative. There is a parallelism between the clinical state of lepromatous cases and their reactions to these tests. In all patients with visceral toxicity they are positive. They are always positive in lepra reaction. Although the reactions are not specific, they give an idea of the condition of the blood protein; the Hanger and cadmium reactions in particular are positive when there is an increase in the blood globulin. They show a correspondence to the present classification of leprosy, which would indicate that the latter has a biochemical basis, a clearer conception of which may be arrived at in the near future. *Ernest Muir*

Brotto, W. Aspectos neurológicos da lepra. [**Neurological Aspects of Leprosy**] *Rev. Brasileira Leprologia.* S. Paulo. 1954, June, v. 22, No. 2, 135–44. [28 refs.]

Floch, H. & Gélard, Anne M. Injection retard, au rythme hebdomadaire, de sulfones solubles (diéthyldiaminodiphénylsulfone et succinyldiaminodiphénylsulfone) en thérapeutique antilépreuse. [**Slow-Absorption Weekly Injections of Soluble Sulphones (Diethyldiaminodiphenyl Sulphone and Succinyldiaminodiphenyl Sulphone) in Treatment of Leprosy**] *Bull. Soc. Path. Exot.* 1954, v. 47, No. 5, 646–52.

It is acknowledged that for mass treatment of leprosy DDS is preferable because of its slow absorption making it possible to give injections at long intervals. But for more individual treatment soluble sulphones may have advantages. The claim of Touzin and Merland [this *Bulletin*, 1954, v. 51, 1168] for the use of the diethyl derivative (M 2196) is based upon its rapid absorption when given intramuscularly and the fact that it is tolerated well. In comparative tests this derivative is compared with the succinyl derivative (1500 F) which has the advantage of being administrable orally, intramuscularly, intravenously, and even locally. Moreover the latter, when given along with polyvinyl-pyrolidone (Subtosan), may be injected intramuscularly once a week (a 25 per cent. solution of 1500 F being used) and yet sufficient blood concentration may be found on the 7th day. Still, it is acknowledged that DDS gives an undoubtedly better slow-absorption action than 1500 F. *Ernest Muir*

Sinha, S. C. P. **Observation on the Treatment of Leprosy with Streptopas (Lepetit) from 1952–54.** *Indian J. Med. Sci.* 1955, Mar., v. 9, No. 3, 124–5.

An account is given of the treatment of 700 leprosy patients, the treatment being a combination of injections of Streptopas [see below], vitamin B, thiosemicarbazone or DDS or a combination of the two, iron and yeast. The only advantages of the use of this combined treatment claimed over simple sulphone treatment are that perforating ulcers respond more quickly, and keratitis and iridocyclitis also respond more rapidly. "Recently it is found that Streptotibina gives still better results." [Streptopas (Lepetit) is dihydrostreptomycin tri-para-amino salicylate, in ampoules of 0·5 gm. Streptotibina (Lepetit) is dihydrostreptomycin tri-isonicotinyl hydrazone of pyrnoic acid, in ampoules of 0·5 gm.] *Ernest Muir*

Terencio, D. J. Injertos laminares en la lepra. [**Sheet Grafts in Leprosy**] *Rev. "Fontilles".* Valencia. 1955, Jan., v. 3, No. 7, 528–31, 8 figs. on 2 pls.

Owing to the use of sulphones the number of patients at Fontilles with lepromatous ulcers of the legs had been reduced from 62·6 per cent. in 1943 to 14·04 per cent. in 1954. However, there are some ulcers of the lower part of the legs which have continued for a long time and refuse to yield to ordinary treatment. The author has found that these may be successfully treated with sheet grafts, either of the thin (0·2 to 0·25 mm.) Thiersch variety, or of the thicker (0·3 to 0·4 mm.) Blair Brown variety.

For 15 days beforehand all treatment is stopped, the ulcer is washed with normal saline and exposed to the sun daily. Vitamin and other general treatment is given. Anaesthesia is produced locally with 1 per cent. Novocaine-adrenaline solution, and an ampoule of Escofedal [not described] is given intravenously. The ulcer is scraped thoroughly and all thick fibrous tissue removed, leaving only a vascular base. The raw surface is covered

with a compress of normal saline while the graft is removed with a razor from a healthy part of the thigh. The graft is stitched into position with fine silk and covered with sterile vaseline gauze for 10 to 15 days. Penicillin, 400,000 units, is given daily for 4 or 5 days. The results obtained were much superior to those obtained with small skin snip grafts.

Ernest Muir

Hadler, W. A. & Ziti, L. M. Efeito da vacinação pelo BCG sôbre a evolução da lepra murina; observação em ratos inoculados, por via peritoneal, com pequena dose de *M. lepraemurium*. [**Effect of Vaccination with BCG on the Evolution of Murine Leprosy; Observation in Rats Inoculated Intraperitoneally with a Small Dose of** *Myco. leprae murium*] *Rev. Brasileira Leprologia.* S. Paulo. 1954, June, v. 22, No. 2, 124–34, 10 figs. & 1 chart. [12 refs.] English summary.

In this experiment 50 rats were divided into 4 groups: 13 were given 25 mgm. of BCG orally; 12 were given 5 mgm. similarly; 12 were vaccinated with 5 mgm. of BCG intramuscularly; and 13 were left as controls. All animals were inoculated with 0·03 mgm. of *Myco. leprae murium* after 90 days, and were observed for 450 days. Between those vaccinated with BCG and the controls there was no difference in the evolution of the disease. While rats vaccinated with BCG do not show in their macrophages the power to destroy mycobacteria like those of leprosy, rat leprosy and tuberculosis, the macrophages of guineapigs vaccinated with BCG do acquire this power.

Ernest Muir

Hadler, W. A. Estudo comparado das lesões provocadas por suspensões de *M. leprae* e de *M. tuberculosis* injetadas por via intradérmica, em cobaios prèviamente vacinados pelo BCG. [**A Comparative Study of Lesions Provoked by the Intradermal Injection of Suspensions of** *Myco. leprae* **and** *Myco. tuberculosis* **in Guineapigs previously vaccinated with BCG**] *Rev. Brasileira Leprologia.* S. Paulo. 1954, June, v. 22, No. 2, 109–23, 10 figs. & 1 graph. English summary.

Ninety-eight guineapigs were inoculated with BCG intramuscularly and intraperitoneally. Of these, 58 were injected 40 days later intracutaneously with 0·05 ml. of BCG suspension, and another 22 with 0·1 ml. of lepromin, while the remaining 20 were injected on the one side with BCG and on the other with lepromin. [There is a discrepancy of 2 in the numbers.]

It was found that in normal guineapigs the cellular reaction was different in the sites of BCG and lepromin injection, only the BCG producing an abscess. But in guineapigs previously inoculated with BCG the cytological and histological appearances were similar in nature. It was found, however, that after observation for 50 days the reaction with BCG was stronger than that with lepromin, but disappeared more rapidly. It is concluded that *Myco. tuberculosis* is more easily lysed than *Myco. leprae*, and that this probably depends on their different structures, chemical compositions and physico-chemical properties. Possibly the lipids account for these differences at least in part.

Ernest Muir

HELMINTHIASIS

In this section abstracts are arranged as far as possible in the following order:—Trematodes (*schistosomes, other flukes*); Cestodes (*Diphyllobothrium, Taenia, Echinococcus, other cestodes*); Nematodes (*Hookworms, Ascaris, Filarial worms, Dracunculus, etc., Trichuris, Enterobius, Trichinella, etc.*).

Corrêa, M. O. A., Fleury, Gilda C., Duarte, Yara N. & Bueno, Risoceia A. Considerações sôbre alguns aspectos das helmintoses em nosso meio escolar. [**Observations on Intestinal Helminths in Schoolchildren in São Paulo**] *Rev. Inst. Adolfo Lutz.* São Paulo. 1954, v. 14, No. 1, 27–31.

The English summary appended to the paper is as follows:—

"With the Willis' method an epidemiological survey of intestinal parasites was made in São Paulo, in 55,764 children from various ages (7–14 years). A total of 70·44% of the examined school-boys harbored helminths and of these there were most frequently encountered: *Trichocephalus trichiurus* (42·83%); *Ascaris lumbricoides* (40·21%); and *Ancylostomidae* (21·54%)."

de Azevedo, J. F. & de Medeiros, Lídia do C. M. A identificação do *Planorbis metidjensis*, Forbes, do Algarve, pela morfologia dos órgãos genitais e rádula, sua comparação com os mesmos elementos do *Planorbis corneus*. [**Identification of** *Planorbis metidjensis* **from Algarve by the Morphology of the Genital Organs and Radula. Comparisons with** *Planorbis corneus*] *Anais Inst. Med. Trop.* Lisbon. 1954, June, v. 11, No. 2, 231–40, 9 figs.

The English summary appended to the paper is as follows:—

"In view of the importance of *Planorbis metidjensis* Forbes and considering the discussion which occurred regarding its classification when the source of the Algarve Bilharziasis was discovered, it was found convenient to again take up the study of its morphology but on a basis of the particularities of the genital organs and radula.

"The description of some examples is made which compare with the *Planorbis corneus* (Linneu), a species to which the *Planorbis metidjensis* is related."

de Azevedo, J. F., da Costa, M. M. & Gomes, F. A. C. A susceptibilidade do *Planorbis metidjensis* ao *Schistosoma haematobium* da Guiné Portuguesa e ao *Schistosoma mansoni* de Moçambique. [**Susceptibility of** *Planorbis metidjensis* **to** *Schistosoma haematobium* **of Portuguese Guinea and to** *S. mansoni* **of Mozambique**] *Anais Inst. Med. Trop.* Lisbon. 1954, June, v. 11, No. 2, 251–60.

The English summary appended to the paper is as follows:—

"Although we are convinced that there is no difference between the biology of the *Schistosoma haematobium* of the South of Portugal and the same species of Africa, it is very interesting to study the susceptibility of the *Planorbis metidjensis* of the country to the various species of the Schistosoma.

"This study is made by comparing the *Schistosoma haematobium* of Portuguese Guinea.

"As it is important to appreciate its susceptibility to the *Schistosoma mansoni* we have proceeded with these studies from the parasitic strain of Mozambique.

"We find that although disposing of a short time and insufficient and inconcrete data, we can point out the following conclusions:

"a) There does not seem to be any susceptibility of the *Planorbis metidjensis, var. dufouri* to the *Schistosoma mansoni.*

"b) We have noted susceptibility of the same Planorbis to the infection with eggs of *Schistosoma haematobium* from Guinea, obtained from patients.

"c) We are obliged to foresee that the greater mortality of *Planorbis metidjensis* in view of the *Schistosoma mansoni* more than in view of the *Schistosoma haematobium*, is due to the action of the parasite."

Davies, A. M. & Eliakim, M. **Bilharzia in Israel: an Immunological Survey amongst Recent Immigrants.** *Ann. Trop. Med. & Parasit.* 1955, Mar., v. 49, No. 1, 9–23, 1 graph & 2 maps. [47 refs.]

There is evidence that schistosomiasis has been present in the Middle East for some 30 centuries. The first published record of its occurrence in Israel was in 1918; in that same year *Bulinus contortus* was found there in water tanks, and after a survey it was established that though *Schistosoma haematobium* infection was not uncommon in certain localities, *S. mansoni* infection was rare. Following the establishment of the State of Israel, in 1948, there was mass immigration of population from schistosomiasis-endemic countries; some 300,000 persons from these had entered Israel by 1952.

A survey of these immigrants has been undertaken, and this is the subject of the present paper. The estimated numbers of persons suffering from schistosomiasis among these immigrants was 40,000. The tests employed for detection of the infected were a skin test, using as antigen extracts prepared from adult *S. mansoni* obtained from experimental animals, and a complement-fixation test done with the same antigen. The results are set out in tables and graphs, and are supplemented by maps of the endemic areas from which the immigrants had come. Of 690 immigrants from Yemen who were examined, 37·9 per cent. of males and 30·4 per cent. of females gave positive tests; for 414 from Iraq the figures were 12·2 per cent. and 4·6 per cent.; for 235 from Iran they were 6·7 per cent. and 6·9 per cent., respectively. Of 356 from Morocco only 1 person gave a positive test; of 48 from Afghanistan 3 persons, while all of 85 from Rumania gave negative tests. As a result of a statistical analysis the authors are of the opinion that the immunological methods of survey they employed are accurate and are convenient for population surveys. They consider that the incidence of schistosomiasis in the persons examined represents a correct picture of its incidence in the countries of their origin. Although at present the incidence of autochthonous infection in Israel is not high the risk is increasing as a result of the entry of these infected people, because the appropriate snail vectors are available in the waterways near which the immigrants settle. *A. R. D. Adams*

Annecke, S., Pitchford, R. J. & Jacobs, A. J. **Some Further Observations on Bilharziasis in the Transvaal.** *South African Med. J.* 1955, Apr. 2, v. 29, No. 14, 314–23, 3 maps. [11 refs.]

East of the Drakensberg lies the Lowveld of the Transvaal and west of it the Highveld. The streams harbour *Physopsis* and *Biomphalaria* snails.

The whole area extends over 60,000 sq. miles and is inhabited by 1½ million Africans and 160,000 Europeans.

Earlier surveys of this area have shown that not only were *S. haematobium* infestations prevalent but also that those of *S. mansoni* were rife. In 1935 a survey was performed on the African schoolchildren in the vicinity of Nelspruit. Out of the 1,056 children examined 657 (62·2 per cent.) were found to be affected with *S. haematobium*. In 1937, 36·6 per cent. of the African schoolchildren along the eastern slopes of the Zoutpansberg were shown to be infected with *S. haematobium*, and in 1938, 64·3 per cent. of the schoolchildren near Tzaneen on the eastern slopes of the Drakensberg harboured the infection.

In the present survey. 20 years later, it was considered of interest to re-assess the position in African children in European farming areas from Tzaneen to Komatipoort where irrigation schemes had been introduced. Urine and stool samples were collected in the field from each subject. The type of country is similar throughout the area in which the survey was conducted, being gently rolling low-lying bush country (600–3,000 ft. above sea level). For purposes of this study it may be divided into European farming areas with irrigation systems and African reserve areas with no irrigation.

(1) *European Farming Areas*

All farm lands in this Lowveld depend for their water supply on irrigation systems. The Africans are housed in compounds. These areas are further classified into (a) farms that offer no protection against schistosomiasis and (b) those on which there is a measure of protection.

(a) *Farms offering no protection against schistosomiasis*

The total percentage of *S. mansoni* infection is 68·5 per cent. and that of *S. haematobium* 66·7 per cent. The 1,600 specimens of urine and 1,600 of faeces tested show that, commencing from age-groups below 4 years, the incidence of both forms reaches a peak in the 10–20-year age-group and then gradually diminishes with age. The picture is one of continuous re-infection starting from earliest childhood. The youngest infant infected with *S. haematobium* was 5 months old and the youngest with *S. mansoni* 7 months. The *S. haematobium* intensity does not appear to diminish until 20–29 years of age, after which it declines with increasing years. The *S. mansoni* intensity remains high till the " over 50 " age-group is reached.

(b) *Farms affording Africans some protection from schistosomiasis*

The difference lies mainly in the form of water supply—closed canals and pumped water. In this group the *S. mansoni* intensity for all ages is 29·3 per cent. and that of *S. haematobium* 49 per cent.—a significant difference from the figures for unprotected farms.

(2) *African Areas*

In these large tracts of country there are no irrigation systems and few dams. The Africans live in close proximity to small rivers and streams in which they bathe and wash their clothes. The *S. haematobium* intensity is high throughout the Reserves and in every way comparable to that in the European farming areas providing no protection. The endemicity of *S. mansoni* is comparatively moderate. Snail infectivity rates throughout the year are considerably higher for *Physopsis* snails in the Reserve area than in the European farming areas. The *Biomphalaria* infectivity rate is

much lower throughout the year in the Reserves and especially low during the winter. The chances of re-infection with *S. mansoni* in the Reserves are less than in the European farming areas, but the risk of re-infection with *S. haematobium* remains high throughout the year.

Control

Schistosomiasis in the Transvaal is running an unchecked course today. Control measures aim at treating a certain number of children and supplying preventive propaganda.

The authors suggest three lines of attack:—

(1) An attack on the vector with pilot schemes to test techniques of snail vector control with concentration at first on small collections of water.

(2) Prevention of contamination of the water. Measures should be applied both to human beings and the waters. Adequate ablution facilities should be provided, with a piped water supply. Latrine accommodation should be supplied and dams should be built above the ground so that contaminated flood-water cannot seep into them. Canals should be covered.

(3) Mass treatment is advocated but this is not easy. It is not practicable to give injections over a period of 7 to 10 days to the whole population. Mass treatment with Nilodin or Miracil D did not produce satisfactory results.

Combined measures in African areas present a far greater problem than in irrigated farming regions. Satisfactory ablution and washing facilities cannot be visualized in African reserve areas.

[For previous studies, see this *Bulletin*, 1952, v. 49, 60.]

M. Geljand

DE AZEVEDO, J. F., COLAÇO, A. T. F. & FARO, M. M. DA C. As bilharzioses humanas no Sul do Save (Moçambique). [**Human Schistosomiasis in South Save, Mozambique**] *Anais Inst. Med. Trop.* Lisbon. 1954, Mar., v. 11, No. 1, 5–120, 110 figs. (43 on 24 pls.).

The English summary appended to the paper is as follows:—

"In view of the results of the studies on human bilharziasis carried out in Sul do Save (South Save) from September 1952 to January 1953, the following conclusions can be drawn in a concise way:

"1st) On account of its climatic and physical characteristics and the way of living of the population favourable conditions can be found for the incidence of bilharziasis all throughout the territory. These will tend to become wider and more serious if they are not controlled.

"2nd) The vesical bilharziasis is uniformly spread over the region; although bilharziasis mansoni is widely spread, it is rather more distributed in spots.

"3rd) The study of the incidence of vesical bilharziasis made principally with the native children of the schools by the examination of the urinary sediment in 9,283 individuals revealed an infection mean rate of 61·5 per cent; that of bilharziasis mansoni performed in individuals of the same age by the searching of eggs in the stools according to a method based on that of Hoffman, Pons and Janer, revealed a mean value of 11·85 per cent of infected individuals in 2,841 observations. The ages most attacked both by one or the other form were from the 20 to 25 years of age.

"4th) Although vesical bilharziasis sometimes is manifested by intense and lasting hematuria we have not observed that it was accompanied by sensitive alterations of the haemoglobin and of the red blood cells. Neutropenia however was observed in the infected individuals; lymphocytosis and

eosinophilia higher than in those not infected were observed. In the healthy and sick natives in whom protein was dosed we verified that the total protein indexes did not differ one from the others and that in all of them there was a decrease of albumin and an increase of the globulin principally of the λ [*sic*, ? γ] -globulin but this one was higher in the infected individuals.

" 5th) In the cases of bilharziasis mansoni in which we studied the protein fractions of the serum the λ [? γ] -globulin was higher than in the cases of vesical bilharziasis.

" 6th) In addition to both the forms of the referred bilharziasis a suspected case of bovine bilharziasis occurred in South in a boy of 13 is reported. The eggs eliminated in his stools presented the characteristics of the eggs of *Sch. bovis*.

" 7th) The European children observed (47 examinations) for the study of vesical bilharziasis were not revealed to be infected; the halfcaste and civilized negro children (93 examinations) presented a mean infection rate of 17·2 per cent.

" 8th) The molluscan host of *Sch. haematobium* is *Physopsis africana* and perhaps *Pirgophysa forskali* also but this one practically in a negligible degree. *Planorbis pfeifferi* is the intermediate host of *Sch. mansoni*. Experimental and field studies permitted to draw these conclusions.

" 9th) *Physopsis africana* is wider distributed than *P. pfeifferi*. This one is rather distributed in spots. *P. forskali* was rarely found and only in small numbers.

" 10th) We have not noted any peculiarities (physical, chemical, flora, etc.) of the collections of the water to both the species although *Ph. africana* was more frequently found in muddy waters than *P. pfeifferi*. The latter was found in waters with more salts, greater hardness and more dry residue. Sometimes both the species were found in association.

" 11th) Besides the cercariae of human type both the referred species of molluscs were frequently found infected by simple fork-tailed cercariae of other types.

" 12th) It was relatively easy to infect monkeys (*Cercopithecus aethiops rufoviridis* I. Geoff) as well as mice with *Sch. mansoni*. The infection of the same animals with *Sch. haematobium* was rarer obtained.

" 13th) In view of the resources which are at the disposal for the combat against bilharziasis as well as in view of the characteristics of the region the general outlines for the combat against those diseases to be settled are discussed after the methods of the combat organized in other countries of Africa had been reviewed."

VAN BEUKERING, J. A. **Symptoms in *Haematobium* Schistosomiasis.** *Documenta Med. Geograph. et Trop.* Amsterdam. 1955, Mar., v. 7, No. 1, 10–15.

The author's experience in the Gold Coast, West Africa, has convinced him that *Schistosoma haematobium* schistosomiasis is a more serious condition than it generally is thought to be, and that it causes a wide variety of symptoms and signs which commonly are missed. These manifestations are discussed and examples quoted. He envisages the possibility that troop movements during the recent war may have resulted in its establishment in the Far East [without reference to the literature or supporting evidence to substantiate this speculation]. *A. R. D. Adams*

Mohamed, A. S. **The Association of Bilharziasis and Malignant Disease in the Urinary Bladder. Pathogenesis of Bilharzial Cancer in the Urinary Bladder.** *J. Egyptian Med. Ass.* 1954, v. 37, No. 9, 1066–85.

Professor Mohamed of Cairo gives an interesting review of the theories advanced on the pathogenesis of schistosomal cancer of the urinary bladder. Although it is recognized that carcinoma is a complication of schistosomiasis, the precise manner in which this occurs is not definitely known despite the fact that it is over 40 years since Ferguson (*J. Path. and Bact.*, 1911, v. 16, 76) first drew attention to the association of the two diseases and called it " the irritation cancer of Egypt ".

Before postulating his own ideas, Mahomed discusses the three main theories.

(1) *The Septic Bladder*

Dolbey and Mooro [this *Bulletin*, 1924, v. 21, 465] suggest that in a secondary infection supervening upon a schistosomal cystitis, the *p*H of the bladder is altered and becomes alkaline. As a result the bladder mucosa, bathed in this medium, is subjected to a chronic irritation and carcinoma follows.

(2) *Mechanical Irritation*

This theory, propounded by Diamantis (*Bull. de la Soc. Roy. Méd. d'Egypt*, meeting of 3rd May, 1934) suggests that during contraction of the bladder the basal layer of the mucosa rubs against the calcified ova in the submucosa and that over many years this epithelial irritation leads to cancer of the mucosa.

(3) *The Toxic Theory*

Makar (*J. Egyptian Med. Ass.*, 1942, v. 25, 14) comparing schistosomal carcinoma of the bladder with the cancer produced by aniline dyes, believes it to be due to the irritative toxins secreted by the schistosomal miracidia and worms. He suggests that the miracidial toxin excites proliferative and hyperplastic elongations of epithelium, and tubular processes dip into the submucosa resulting in a precancerous condition which he calls " cystitis glandularis ". Makar believes, too, that the ova become trapped in the bladder wall and their toxins accumulate locally, thus exercising an irritating action on the covering epithelium. As more and more ova are trapped the toxins accumulate in sufficient concentrations to cause the epithelium to become malignant.

Mohamed opposes Diamantis's theory of schistosomal irritation on the grounds that most of the ova are deposited in the submucosa where they are not in contact with the epithelium. Nor does he agree with Makar's theory. He believes that as the submucosal fibrosis increases, the amount of toxin reaching the living epithelium decreases, since the toxins cannot accumulate but pass into the general circulation.

In a study of 16 personal cases of schistosomal cancer of the bladder, Mohamed classified the carcinomata as follows:— 9 epidermoid; 2 transitional; 2 undifferentiated; 2 sarcoma; 1 adenocarcinoma. The epidermoid cancers arose from squamous epithelium not normally present in the urinary bladder. It is known that as a result of chronic inflammation in bronchiectatic cavities or chronic irritation by gallstones, the normal columnar epithelium becomes squamous in type. In the same way chronic irritation in the bladder by calculi or phosphatic incrustations results in a squamous metaplasia of the bladder—a precancerous condition. In the schistosomal

bladder schistosomiasis *per se* does not produce metaplasia, but only hyperplasia of the epithelium. Severe chronic schistosomal infection in most cases is complicated by suppurative cystitis, which in time becomes chronic. Suppurative inflammation in schistosomal cystitis is often the result of infection by streptococci and staphylococci which render the tissues alkaline. This septic state results in the formation of large phosphatic calculi and is the chief cause of squamous cell metaplasm which ultimately gives rise to a high percentage of epidermoid carcinoma.

To account for the group of transitional cell carcinoma of the bladder, Mohamed suggests that it is due to injuries and repair repeated over many years. The sarcomata he considers the result of the continuous deposition of ova in the submucosal and muscular coats and suggests that the continuous mobility of ova in these two coats leads to sarcomatous degeneration. *M. Gelfand*

Rugai, E. Contribuição à epidemiologia da esquistossomose mansônica no Estado de S. Paulo. [**Epidemiological Observations on** *S. mansoni* **Infection in São Paulo State**] *Rev. Inst. Adolfo Lutz.* São Paulo. 1954, v. 14, No. 1, 9–11.

The English summary appended to the paper is as follows:—

"Five *Australorbis* foci were found in Bauru.

"The specimen was identified as *A. tenagophilus* D'Orbigny, 1847 (= *A. nigricans*, Lutz 1918).

"The search of 'cercarias' was made in 1,073 mollusc specimens.

"*Cercaria hemiura* was found in two foci.

"*S. mansoni* cercaria was not found."

Fiorillo, A. M., Jamra, M., Eston, V. R., Eston, T. E. & Pagano, C. Volemia na forma hepato-esplenica da esquistossomiase mansoni. [**Blood Volume in the Hepato-Splenic Form of Schistosomiasis mansoni**] Reprinted from *Rev. Assoc. Med. Brasil.* 1954, June, v. 1, No. 2, 173–5, 1 fig. [13 refs.]

The English summary appended to the paper is as follows:—

"In 11 patients with hepato-splenomegalic form of Manson's schistosomiasis (hepatic cirrhosis form of schistosomiasis) the authors determined simultaneously the plasma volume with T-1824 dye (Evans blue) and the red cell volume with P^{32}.

"An increase of the whole blood volume and an increase of the plasma volume were found. The red cell volume when expressed in milliliters per Kg of body weight, was not reduced, while it was slightly reduced when the absolute values were taken."

Fiorillo, A. M. Estudo eletroforético do sôro de pacientes portadores de esquistossomose mansoni hepato-esplênica. [**Electrophoretic Study of the Serum of Hepato-Splenic Schistosomiasis Patients**] *Hospital.* Rio de Janeiro. 1954, May, v. 45, No. 5, 647–51, 2 figs.

The English summary appended to the paper is as follows:—

"The author presents the electrophoretic pattern of 10 cases of Schistosomiasis mansoni with hepato-splenomegaly. The electrophoretic determinations were done with filter paper by the Grasmann method. Every case

was found low in albumin and γ globulin was always much increased; a sharp separation between β globulin and γ globulin spikes were not seen. The correlation between the cephalin-cholesterol flocculation and the formol-gel tests and the electrophoretic pattern was studied. The author also concluded that the pattern obtained is equal to the one of Laennec cirrhosis.

"The author suggested further studies on the subject."

DE FARIA, J. L. **Pulmonary Vascular Changes in Schistosomal Cor Pulmonale.** *J. Path. & Bact.* 1954, Oct., v. 68, No. 2, 589–602, 21 figs. on 3 pls. [35 refs.]

Schistosomal cor pulmonale, due to *Schistosoma mansoni* infection, is a rare condition in Brazil; the author has studied the lungs from 10 patients suffering from it; he has also examined as controls the lungs from 8 patients with schistosomiasis who were not suffering clinically from this lung complication. The clinical data, the findings at necropsy, the methods of preparation, and the general histological findings have already been recorded [this *Bulletin*, 1954, v. 51, 282; and also *Amer. J. Path.*, 1954, v. 30, 167]. The purpose of the present paper is to report on the pulmonary lesions in cases of cor pulmonale which are not directly ascribable to the presence of ova.

The changes observed in the small pulmonary arteries of cases of cor pulmonale. in diminishing order of frequency, were hyaline thrombosis, an active endarteritis, and diffuse intimal fibrous thickening. In association with these changes there was enlargement, hyperplasia and mobilization of the lining endothelial cells of the vessels, which in some cases formed focal agglomerations. The nuclei of these cells occasionally showed regressive changes such as ballooning, pyknosis and karyorrhexis. The pulmonary capillaries were hyperaemic and dilated. The endarteritis, which was of a serous, fibrinous or haemorrhagic type, was not due to the actual presence of the ova but possibly was caused by circulating substances liberated by them; the histopathology in fact suggests an allergic type of reaction in the vascular intima. The endarteritis seen in the pulmonary vessels in cases of cor pulmonale due to *S. mansoni* schistosomiasis is similar to that described in rheumatic fever, thrombo-angiitis obliterans, polyarteritis nodosa, and primary pulmonary arteriosclerosis. Fibrinous thrombi occasionally were seen in branches of the bronchial arteries and pulmonary veins, but they were rarely occlusive; the most striking and consistent finding was the fibrous thickening of the intima, which was diffuse and marked, causing great narrowing of the lumen. It is these lesions, in addition to schistosomal granulomata, which impede the pulmonary arterial circulation.

The diffuse changes described above were not found in the control cases free from the cor pulmonale syndrome.

"Cor pulmonale in Manson's schistosomiasis is a consequence of either widespread relapsing pulmonary endarteritis followed by intimal fibrous thickening, or pulmonary arterial obstruction by schistosomal granulomas. In 9 out of 10 cases, endarteritis and intimal fibrosis were the main obstructive factors. In the remaining case . . . with an intimal reactivity comparable to that of the control group, schistosomal granulomata were the main obstructive factor.

"The infrequency of cyanosis in schistosomal cor pulmonale may be due to the absence of diffuse and severe sclerosis of the pulmonary capillaries."

A. R. D. Adams

Dias, E. Nota prévia sôbre ensáios de combate aos planorbídeos por métodos biológicos e bioquímicos. [**Preliminary Note on Trials of Biological and Chemical Methods in the Control of Planorbids**] *Mem. Inst. Oswaldo Cruz.* 1954, Mar., v. 52, No. 1, 247–52, 11 figs. on 7 pls.

In 1952, the author studied the possibilities of microbiological control of planorbids [this *Bulletin*, 1953, v. 50, 825] and noted the encouraging results with *Bacillus pinottii* described by Cruz and himself, from the Oswaldo Cruz Institute [*ibid.*, 1954, v. 51, 284; see also 1955, v. 52, 660]. He has now brought this study further and presents a preliminary note on trials made in selected areas infested with *Australorbis glabratus* (in Bambuí) or *A. nigricans* (*immunis*) (in Jacarepaguá).

B. pinottii in peptone cultures was particularly successful, and in one large focus *A. glabratus* was almost completely eliminated for nearly a year after a single application. A number of non-sporing bacteria isolated from molluscs, were found to have a profound destructive effect on the shells of *A. glabratus* and this is well illustrated in a photograph. In water treated with *Saccharomyces cerevisiae* in relatively high concentrations, certain foci of *A. glabratus* were almost exterminated and there appeared to be a residual action for 3 weeks in stagnant water.

A. nigricans was rapidly killed in 2 tests made with residual products from a distillery.

The author draws attention to the possibilities of these methods in the eradication of planorbids, but notes the further possibility that development of resistance to bacterial agents may occur. *H. J. O'D. Burke-Gaffney*

Cridland, C. C. **The Experimental Infection of Several Species of African Freshwater Snails with** *Schistosoma mansoni* **and** *S. haematobium*. *J. Trop. Med. & Hyg.* 1955, Jan., v. 58, No. 1, 1–11, 1 map.

The susceptibility of 19 species or subspecies of water snails to infection with *S. mansoni* or *S. haematobium* was tested. The snails were collected in Nyanza Province, Kenya, and various localities in Uganda. Schistosome eggs used in the experiments were obtained from patients in both Uganda and Kenya. Laboratory-bred snails were used in most of the experiments and white mice were exposed to infection with cercariae when these were shed.

Five species of *Biomphalaria* were found to be susceptible to infection with *S. mansoni*, namely, *B. choanomphala*, *B. adowensis adowensis*, *B. sudanica sudanica*, *B. sudanica tanganikana* and *B. rüppellii*. *B. adowensis adowensis* and *B. rüppellii* were highly susceptible and gave infection rates of 66 to 100 per cent. The other species showed lower infection rates but are regarded as important carriers.

Bulinus (*Physopsis*) *nasutus* was proved to be susceptible to infection with *S. haematobium*, up to a rate of 56 per cent. Naturally infected "wild" snails of this species were found. It is a fairly common species in Uganda and must be regarded as an important vector. *Bulinus* (*Physopsis*) *globosus globosus* was also susceptible, up to a rate of 62 per cent. and naturally infected snails were found. This is a rare species in Uganda.

The following species were exposed both to *S. mansoni* and *S. haematobium* infection but did not become infected: Planorbinae: *Anisus natalensis*, *Segmentorbis kanisaensis*, *S. angusta;* Bulininae: *Bulinus* (*Phys.*) *africanus ovoideus*, *B.* (*Phys.*) *globosus ugandae*, *Bulinus forskalii*,

Bulinus scalaris, *Bulinus* (*B.*) *trigonus trigonus*, *B.* (*B.*) *trigonus strigosus*, *B.* (*B.*) *trigonus transversalis*. *Lymnaea natalensis caillaudi* did not become infected when exposed to *S. haematobium*.

"No evidence was found to support the idea that there may be local strains of either *S. mansoni* or *S. haematobium* with varying degrees of infectivity." *J. J. C. Buckley*

KUNTZ, R. E. & MALAKATIS, G. M. **Susceptibility Studies in Schistosomiasis. II. Susceptibility of Wild Mammals to Infection by** *Schistosoma mansoni* **in Egypt, with Emphasis on Rodents.** *Amer. J. Trop. Med. & Hyg.* 1955, Jan., v. 4, No. 1, 75–89. [15 refs.]

A number of wild mammals were exposed to infection with *S. mansoni* to find out the species susceptible to infection and likely to act as reservoir hosts. These comprised 9 species of rodents, 3 carnivores and one insectivore, all from Lower Egypt. Cercariae were obtained from naturally infected *Biomphalaria boissyi* and the animals were exposed by the immersion method. The results of the exposure of each kind of host are described and discussed in detail.

Mus muscular praetextus, the common house mouse. This was found to be a favourable host and reacted similarly to the albino mouse in which the course of infection is well known.

Rattus rattus, the common house rat. Like its laboratory counterpart, the albino rat, this is an unfavourable host for *S. mansoni*.

Arvicanthis niloticus, the Nile rat. This is considered one of the best hosts. It provides numerous well-developed parasites and eggs, and a typical pathological picture.

Acomys cahirinus, the spiny-back mouse, can be readily infected with moderate numbers of parasites, and the infection resembles that in albino mice. It has the disadvantage of having a delicate skin which is easily damaged.

Gerbillus pyramidum, the gerbil or common desert mouse, ranks second to the house mouse in egg production by its parasites, but is not a good experimental animal on account of the high death rate after exposure.

Jaculus jaculus, the jerboa or desert jumping mouse, like the gerbil is unsuitable owing to high mortality rate.

Psammomys o. obesus, the fat sand rat. None of these animals lived more than 4 to 6 days after exposure to infection.

Meriones s. shawi, the jird, is a suitable host but inferior to the house mouse and the Nile rat. It breeds well in captivity and is adaptable.

Nesokia indica suilla, the Egyptian bandicoot, is "very susceptible to infection". Female worms predominated in this host, unlike most other hosts. Pathological conditions were not outstanding and this, together with the difficulties of handling it in the laboratory, class it as an unsuitable experimental host.

Hemiechinus auritus, the Egyptian hedgehog, a common insectivore in lower Egypt, produced few well-developed parasites and the eggs, in liver and intestine only, were mostly non-viable. Taken all round, this was an unfavourable host for *S. mansoni*.

Mustela nivalis subpalmata, the Egyptian weasel. This carnivore is difficult to handle and refractory to infection with *S. mansoni*. None of the 6 animals exposed lived for more than 5 days.

Herpestes i. ichneumon, the Egyptian mongoose. Very heavy cercarial infections of 2 of these animals resulted in comparatively few adult parasites, none of which produced viable eggs.

Vulpes v. aegyptiaca, the common Egyptian fox. Very heavy cercarial infections of 3 of these hosts resulted in no parasites or evidence of parasitism 6 to 10 weeks later.

These experimental studies were followed up by examination of about 500 rodents and other small mammals from areas where a high incidence of *S. mansoni* was known to occur, with a view to discovering possible reservoir hosts. With the exception of one gerbil having a natural infection, believed to be accidental, none of these was found infected. Even the Nile rat, a very likely reservoir, in view of its habits and susceptibility, proved negative although 100 were examined.

The authors comment on the non-specificity of *S. mansoni* for its definitive hosts and mention previous reports, by other workers, of various hosts, excluding primates, *e.g.*, *Euphractus sexcinctus* (hairy armadillo), *Procyon cancrivorus* (crab-eating raccoon), *Oryzomys palustris* (rice rat), *Dasyprocta aguti* (agouti), *Cricetus auratus* (Syrian hamster) and *Sigmodon hispidus* (cotton rat). *Rattus r. frugivorus* found naturally infected in Brazil with *S. mansoni* in 1953 and various species of wild rodents found naturally infected in the Belgian Congo with *S. mansoni* var. *rodentorum* [this *Bulletin*, 1954, v. 51, 72] are of particular interest. The authors claim the addition of 8 species of rodents, one carnivore and an insectivore to the list of hosts of *S. mansoni*. [There are two notable omissions from this list, *viz.*, domestic cat (LeRoux, *Trans. Roy. Soc. Trop. Med. & Hyg.*, 1950, v. 44, 3) and puppy (Pinta and Almeida, *Rev. Brasileira Biologia*, 1945, v. 5, 219). Also worth mentioning in this connexion is the occurrence of the closely related *S. rodhaini* as a natural infection of dogs, 16 out of 29, and of *Felis serval* in Ruanda-Urundi (this *Bulletin*, 1954, v. 51, 74).]

"Observations in this investigation supplement other reports and descriptions of conditions recorded in previous susceptibility studies: (1) splenomegaly does occur in wild, as well as in small laboratory mammals infected experimentally with *S. mansoni*. Our data do not give conclusive information indicating an exact relationship of incidence and degree of splenic enlargement as related to parasite loads or duration of infection. (2) Measurements of parasites from both favorable and only fair hosts cover quite a range, thus supporting our previous contention that size alone cannot be employed as a criterion for judging the normality of the worms. (3) Our data further indicate that there is a natural predominance of male parasites. Male worms were in the majority in most categories of hosts examined. A notable exception was in the bandicoot in which 72 per cent of the worms recovered were females. (4) Furthermore this study, in agreement with similar work by others (Evans and Stirewalt, 1951) indicates that the recovery of worms from hosts varies with the different batches of cercariae for infection purposes." *J. J. C. Buckley*

Kuntz, R. E. & Malakatis, G. M. **Susceptibility Studies in Schistosomiasis. III. Infection of various Experimental Hosts with** *Schistosoma haematobium* **in Egypt.** *Exper. Parasit.* New York. 1955, Jan., v. 4, No. 1, 1–20. [11 refs.]

Eleven different kinds of laboratory animals, 472 in all, were exposed to infection with *S. haematobium* in order to evaluate their susceptibility to this parasite. The animals used were albino mice, hamsters, albino rats, cotton rats, guineapigs, rabbits, dogs, cats, goats, monkeys and baboons. All the albino mice (77) and hamsters (22) exposed became infected and together with monkeys and baboons are considered as good hosts for experimental studies, although all 4 exhibit varying degrees of susceptibility.

Albino rats, cotton rats and guineapigs are poor hosts; rabbits and dogs are refractory; goats produce very small numbers of parasites and so also do cats, in which the parasites were subnormal. Only in hamsters and in the primates was the urogenital system infected, but by no means constantly and the pathological changes in the primates were inconsistent and only in some of these hosts was the urinary bladder involved. Eggs and parasites were found in the region of the bladder of hamsters, with tissue damage, but in mice only eggs were found in this organ. Splenomegaly was common in the mice but not usually in hamsters and in the primates it was " surprisingly low ". It did not occur in albino rats, cotton rats or guineapigs. There is much detailed information in this paper which makes it impossible to summarize satisfactorily.

In their concluding remarks the authors comment on the discrepancy between the results of different workers on the subject of experimental infection of laboratory animals with *S. haematobium* and state that " there is a great need for further study to clarify physiologic, genetic, taxonomic and geographic relationships between the parasite and its possible intermediate and definitive hosts ".

J. J. C. Buckley

Lagrange, E. Au sujet de la mort dans la bilharziose expérimentale. [**Death in Experimental Schistosomiasis**] *Ann. Soc. Belge de Méd. Trop.* 1954, Dec. 31, v. 34, No. 6, 929–30.

The English summary appended to the paper is as follows:—

" Intestinal bleedings occur frequently during the period of egg elimination in mice infected with *S. mansoni*. They are accidental, subside spontaneously, while death may appear without visible hemorrhage. The presence of blood in the feces of mice is detected by the classical benzidine test."

[See also this *Bulletin*, 1951, v. 48, 1012.]

Sandground, J. H. & Moore, D. V. **Notes on the Rearing of *Oncomelania* spp. in the Laboratory.** *J. Parasitology.* 1955, Feb., v. 41, No. 1, 109–13, 3 figs.

The authors describe two innovations which they consider provide improvements on older procedures for the rearing of gill-breathing, semi-aquatic snails, belonging to the genus *Oncomelania*. The first of these techniques describes how the snails may be maintained in Petri dishes set up to imitate the conditions in the larger tanks. These miniature aquaria permit examinations of their contents under low powers of the microscope and are of particular value in allowing previously infected snails to be easily accessible for periodic examinations. The second innovation is concerned with a new method of preparing food for the snails in a form which allows the easy removal of the uneaten surplus, thus preventing an accumulation of débris which tends to foul the habitat and upset the balance of the aquarium. This result is obtained by employing a modification of Standen's technique [this *Bulletin*, 1951, v. 48, 901] and consists in impregnating strips of filter paper with soluble sodium alginate previously mixed with the selected food material, and then coagulating the alginate with calcium chloride solution. The treated paper strips are laid on the mud bank with the ends dipping into the water reservoir. The snails migrate from all parts of the aquarium to the food strips which are removed every few days and fresh strips substituted.

R. M. Gordon

Germer, W. D., Yong, M. H., Schulze, W., Jeltsch, R. & Orrahood, M. D. Die Klinik der Clonorchiasis. [**Clinical Features of Clonorchiasis**] *Ztschr. f. Hyg. u. Infektionskr.* 1955, v. 141, No. 2, 132–45, 3 figs.

The authors report 132 cases of clonorchiasis in natives of South Korea, where infection with *Clonorchis sinensis* is very common. The histories, symptoms and signs together with the results of laboratory investigations (erythrocyte and leucocyte counts; sedimentation rates; blood bilirubin, Takata-Ara, thymol turbidity and cadmium serum reactions; measurement of plasma proteins and paper electrophoresis; bromsulphthalein retention; urine protein; faecal examination for *Ascaris*, *Trichuris* and hookworm eggs) in 102 patients are reviewed in detail.

Persons infected with *Clonorchis* can be classified as either symptom-free carriers, *i.e.*, uncomplicated clonorchiasis with no obvious liver damage, or as clonorchiasis with liver cirrhosis (portal or biliary).

The number of worms and the duration of infestation were major factors in determining the outcome of infestation. Concurrent liver damage was also important, especially that due to alcohol. The importance of malnutrition including protein deficiency was difficult to ascertain since a large proportion of the population are undernourished.

The epidemiology of Korean clonorchiasis is to be described by the authors in a future paper. They report, however, that over 90 per cent. of their patients were eaters of raw fresh-water fish. Infection was most common in adults between 20 and 50 years of age and commoner in males than in females.

Symptoms of infection were largely non-specific and included weakness, lassitude, loss of weight, epigastric discomfort and paraesthesias. A relatively common complaint was impotence. Meteorism, diarrhoea, and oedema were common in patients with cirrhosis.

Of the 55 with " uncomplicated " clonorchiasis, 29 had an enlarged, hard or tender liver. The left lobe was most commonly involved. Of the 47 with cirrhosis, 36 had an enlarged or hard liver and 14 had an enlarged spleen. In the latter, 12 had icterus, 21 ascites, and secondary signs of cirrhosis, including angiomata, were common. Testicular atrophy occurred in 8, and gynaecomastia in 5. Ten patients had biliary cirrhosis with partial obstruction.

Laboratory findings were also non-specific. The sedimentation rate was commonly raised and changes in electrophoretic protein pattern occurred in 87 per cent. of 37 uncomplicated and 41 cirrhotic cases.

The authors consider that study of the electrophoretic pattern is valuable in determining the development of liver damage.

The thymol and cadmium flocculation tests were positive in a higher proportion of cirrhotic than of uncomplicated cases. The Takata-Ara test was positive more commonly in the former. Bromsulphthalein retention was observed in 25 of 29 cirrhotic patients and 11 of 34 of the uncomplicated. It is suggested that this test is particularly valuable in that it gives the earliest indication of changes in hepatic excretary function.

Blood bilirubin was raised in 12 of 39 cirrhotic cases and urinary urobilinogen in 20 of 47, compared with 6 of 53 uncomplicated cases.

Anaemia (haemoglobin less than 60 per cent.; red cells less than 3·0 million cells per cmm.) was relatively uncommon even in the cirrhotic cases. Leucopenia occurred in 13 of 46 in the latter group and in only two of 52 uncomplicated cases.

Eosinophilia was common but the majority of subjects were infected with other worms.

B. G. Maegraith

Chung, Huei-lan & Hou, Tsung-ch'ang. **Chemotherapy of Paragonimiasis. Further Observations on the Efficacy of Chloroquine.** *Chinese Med. J.* Peking. 1954, Nov.–Dec., v. 72, No. 6, 407–27, 4 figs. on 2 pls.

This is a report on the cure of paragonimiasis with chloroquine in 7 cases; of these, 3 were classed as severe and another as very severe. The patients had all received emetine before the treatment with chloroquine was started and 2 were given further emetine during the courses of treatment here reported. The emetine treatment had produced prompt symptomatic improvement, but early relapses had occurred.

Chloroquine was given by mouth in doses up to 0·25 gm. of the base twice daily in young children and up to 0·5 gm. twice daily in adults, over a period of 93 to 231 days; the total dosage varied from 26·84 to 85·75 gm. The total period of observation in hospital varied from 5½ to 9½ months.

Symptoms, except cerebral symptoms, gradually disappeared, the sputum was reduced in amount and became free from blood. Ova in the sputum were reduced in numbers at an early date and the few found showed degenerative changes; eventually they all disappeared. The amount of chloroquine given at the time of the final disappearance of ova varied from below 8 gm. in one patient, between 10 and 25 gm. in 4, and 60 and 63 gm. in the remaining 2 cases.

No severe toxic symptoms were noted but in most there were minor disagreeable symptoms, including muscular weakness, which made it necessary to modify the dosage from time to time.

All 7 were cured of the infection and showed no relapse during the period of observation; one patient died with increased intracranial pressure 71 days after treatment had been stopped and although extensive lesions, including a cerebral lesion caused by the worms, were found, none of these worms was alive and no viable ova were found.

The authors consider that this is a drug of great promise in the treatment of paragonimiasis. *L. E. Napier*

Silverman, P. H. **Studies on the Biology of some Tapeworms of the Genus *Taenia*. II.—The Morphology and Development of the Taeniid Hexacanth Embryo and its Enclosing Membranes, with some Notes on the State of Development and Propagation of Gravid Segments.** *Ann. Trop. Med. & Parasit.* 1954, Dec., v. 48, No. 4, 356–66, 3 pls. & 2 text figs. [26 refs.]

" Observations are recorded on a series of whole tapeworms and on several hundred gravid segments of *Taenia saginata* and *T. pisiformis*. The results may be summarized as follows.

" 1. *The Ripening and Propagation of Gravid Segments*

" (*i*) Although immature ova may be found in the posterior 100 segments of tapeworms consisting of 600–900 proglottids, mature ova in varying percentages (0–80 per cent.) are found only in the terminal 30–50 segments. which appear to ripen independently of their chronological order.

" (*ii*) All gravid segments are not necessarily sources of cysticercosis, since some (about 10 per cent. of those examined) contain only ' infertile ' ova. A tapeworm-carrier who passes typical gravid segments containing mature infective eggs on one day may, on another day, pass segments containing only immature or infertile ova.

" (*iii*) After expulsion from the host, some immature ova, when stored at

room temperature in normal saline, require about two weeks for maturation, while others apparently do not mature even after as long as two months.

" (*iv*) The number of segments passed by individuals harbouring single tapeworm infections varies from none for a few days to as many as 12 in one day.

" 2. *The Morphology and Embryology of the Hexacanth Embryo*

" (*i*) Morphologically and histologically the eggs of *T. saginata* and *T. pisiformis* are indistinguishable. Starting from the innermost membrane, the *Taenia* hexacanth embryo is enclosed by (a) a thin limiting membrane, (b) a stout oncospheral membrane, (c) the basement membrane of the embryophore, (d) a thick embryophore composed of innumerable wedge-shaped blocks, (e) yolk cells and yolk material, (f) an outermost chorionic membrane.

" (ii) The embryology of the hexacanth embryo is described, as it develops from an undifferentiated 22-cell-stage organism to a mature six-hooked form containing a bilobed secreting gland. This secreting gland, which is reported for the first time in a taeniid embryo, compares in its staining qualities to similar glands in *Moniezia* hexacanth embryos.

" (iii) Consideration is given to the histology of the various cellular constituents of the hexacanth embryo, and to the significance of their staining reactions to methyl-green pyronin, which differentiates between desoxyribonucleic acid and ribonucleic acid. The hexacanth embryo is found to consist mainly of two types of cells, small blue-green ones and larger pyroninophilic forms. The immature embryo contains 20–25 small blue forms and no large red ones; the mature embryo is made up of 7–8 red cells and 8–10 small blue ones. The large red-staining cells are thought to be derived from the smaller forms.

" (iv) The six larval hooks and their musculature are discussed.

" (v) Sections of expelled gravid segments reveal that all gravid segments contain significant numbers of immature embryos."

Pellegrini, D. & Cilli, V. L'idatidosi in Italia. [**Hydatid Disease in Italy**] *Ann. d. San. Pubblica.* Rome. 1955, Jan.–Feb., v. 16, No. 1, 81–106, 7 graphs & 1 map. [14 refs.]

The English summary appended to the paper is as follows:—

" The authors report the results of a statistical survey carried out in Italy in order to ascertain the actual diffusion of both human and animal hydatidosis.

" The following conclusions are drawn from the data collected:

" 1.—The nation wide average rates regarding infestation of adult animals are stated as follows: cattle 9·15%, sheep 23·91%, goats 9·72%, swine 3·50%.

" 2.—The average rates concerning geographical distribution of this parasitosis result apportioned as follows:

Northern Italy: cattle 4·08%, sheep 15·93%, goats 1·82%, swine 1·12%;

Central Italy: cattle 11·45%, sheep 21·74%, goats 8·14%, swine 3·41%;

Southern Italy: cattle 13·27%, sheep 14·94%, goats 10·33%, swine 4·34%;

Insular Italy: cattle 31·62%, sheep 52·52%, goats 10·25%, swine 8·66%.

" Relying upon the above data it is possible to divide the national territory into three areas, namely northern area, centro-southern area, and Sardinian area, whose incidence is low, mild and high respectively.

" 3.—The cases of human hydatidosis ascertained during the period 1941–1952 were 5048 and resulted distributed as follows: northern Italy 420, central Italy 1353, southern Italy 1052, and insular Italy 2092 (no information about 131 cases).

" 4.—The study of the human case records shows that hydatidosis was progressively increasing in Italy during the last 12 years. The year average of 240 cases recorded during the period 1941–1947 rose to 672 during 1948–1952.

" 5.—After stating the suitability of appointing a Central Committee for hydatidosis as well as of enacting special rules in this field, the authors propose a scheme of prophylaxis aiming at removing either dogs' infestation or the possibility of their reinfestation. To conclude they maintain the necessity of promoting a campaign in order to improve the hygienical conscience of population.'

Harada, F. **Investigations of Hookworm Larvae. III. Biological Observations of Infective Larvae in Migration towards Vegetables.** *Yokohama Med. Bull.* 1954, June, v. 5, No. 3, 212–29, 12 figs. [14 refs.]

The author made observations on the migration of infective larvae of *Ancylostoma caninum* and *A. duodenale* with species reference to their behaviour on the stems and leaves of young radishes, *Raphanus sativus*. These were grown to a height of about 5 cm. in sandy soil in Petri dishes 9 cm. in diameter to which the larvae were added. After some time the larvae were counted on the leaves, leaf-stalks and upper, middle and lower parts of the stem. Five thousand larvae were usually employed in each experiment. After 24 hours at 11–11·5°C. living larvae were recovered from all parts of the plant but mostly from the lower stem. The total recovery of *A. duodenale* was 0·48 per cent. and of *A. caninum* 1 per cent. After 24 hours at 27·5°C. and a humidity of 87 per cent., the recovery of larvae (*A. caninum* only) was 5·1 per cent. in darkness and 8·1 per cent. in light; a much higher proportion of larvae migrated to the upper parts of the plants than at the lower temperature of the previous experiment.

At intervals of 10, 25 and 35 hours at 25–26°C. and humidity of 74–75 per cent. the percentage recovery of larvae of *A. duodenale* was 0·3, 1 and 1·8 respectively.

An outdoor experiment with *A. caninum* larvae designed to compare migration activity during the day and at night showed that there was more active migration at night, *viz.*, 3·1 per cent. recovery of larvae as against 0·82 per cent., daytime in light shade, and 0·24 per cent., daytime in sunlight. In a similar experiment of 7 hours' duration on a cloudy day only 0·82 per cent. of the larvae migrated up the plants. On the other hand on a rainy night, from 9 p.m. to 9 a.m. there was a 26·2 per cent. recovery of larvae, most of which were on the lower and middle stems of the plants. An experiment to determine the fate of larvae migrating up the plants showed that there was 24·1 per cent. mortality in one group and 33·8 per cent. in another group over a given period of exposure. A similar experiment, however, gave much lower figures, 6·8 per cent. and 0·4 per cent. Cloudy and windy conditions of exposure were shown to produce a high mortality.

The height to which larvae could migrate on a plant was investigated. After 24 hours it was found that a few larvae of *A. caninum* climbed 30 cm. up a wild plant, *Hosta* sp., and 40 cm. after 48 hours. *J. J. C. Buckley*

Harada, F. **Investigations of Hookworm Larvae. IV. On the Fly as a Carrier of Infective Larvae.** *Yokohama Med. Bull.* 1954, Aug., v. 5, No. 4, 282–6, 3 figs.

By introducing flies (*Musca domestica* and *Calliphora* sp.) into a closed vessel 9 cm. in diameter containing sandy soil on which 5,000 infective larvae of *Ancylostoma caninum* were spread, it was shown that the larvae could become adherent to the flies, usually to the pulvilli or the bristles. After one hour an average of about 7 larvae was recovered from 12 *M. domestica* and an average of about 37 from *Calliphora*. Mechanical transmission of the larvae by flies is thus possible and also infection of definitive hosts through this agency, the most likely method being the deposition of larvae on food or in drink. *J. J. C. Buckley*

Rugai, E., Mattos, T. & Brisola, A. P. Nova técnica para isolar larvas de nematóides das fezes. Modificação do método de Baermann. [**A Modification of Baermann's Technique for isolating Nematode Larvae from Faeces**] *Rev. Inst. Adolfo Lutz.* São Paulo. 1954, v. 14, No. 1, 5–8, 1 fig. [11 refs.] English summary (8 lines).

The authors, in Bauru, Brazil, have modified Baermann's technique, so that the simplest equipment could be used. They employed a conical flask, into which was fixed, at a slight inclination, the faeces container wrapped in a piece of gauze folded 2–4 times and pulled over the back of the container. Water at a temperature of 40°–42°C. was placed in the flask so that it reached the mouth of the container. The apparatus was allowed to stand for 90 minutes and the larvae, which collected at the bottom of the flask, were removed with a Pasteur pipette.

From 259 specimens of faeces, larvae of *Strongyloides* or of ankylostomes or both were recovered in 123 by a combination of Baermann's method and the authors' modification, in 116 by Baermann's method alone and in 120 by the modified method.

The new method is claimed to be efficient, practical, hygienic and economical. *H. J. O'D. Burke-Gaffney*

Tuboku-Metzger, A. F. **Case of *Ascaris lumbricoides* Infestation associated with Priapism.** *West African Med. J.* 1955, Mar., v. 4 (n.s.), No. 1, 42.

Gabbard, Mildred B., Kotcher, E. & Pulliam, E. D. **Evaluation of Hetrazan as an Anthelmintic in Children.** *Pub. Health Rep.* Wash. 1954, Nov., v. 69, No. 11, 1087–90.

A campaign to diminish intestinal helminthiasis was carried out in an area in Kentucky, U.S.A., and as a part of this campaign, diethylcarbamazine (Hetrazan) was given to two groups of schoolchildren known to be infested with worms.

In the first group, which contained 81 white schoolchildren, 200 mgm. were given 3 times daily at 3-hour intervals for 5 days to children aged 7–10 years. In the second group, which contained 68 white schoolchildren, each child was given 12 mgm. per pound body weight in 3 divided doses on the first day. Owing to toxic symptoms, the dose was then reduced to 6 mgm. per lb. daily (divided into 3 doses) for 4 more days. As a result

of this treatment, the children passed (or vomited) many worms, up to 100 after one treatment. In the first group of children, before treatment 100 per cent. contained *Ascaris*, 68 per cent. passed *T. trichiura* ova and 33 per cent. passed hookworm ova. Examination made 1–2 weeks after treatment showed that 42 per cent. had ceased to pass *Ascaris* ova; 40 per cent. of those with *T. trichiura* had ceased to pass ova; and 7 per cent. of those with hookworm had become negative. In the second group, examination 2–3 weeks after treatment showed that 53 per cent. had ceased to pass *Ascaris* ova; but after 3–4 weeks only 27 per cent. of the children were still free from *Ascaris*.

It is concluded that the drug is not effective against hookworm and that it is not very effective against *T. trichiura*. Diethylcarbamazine was considered to be less effective against *Ascaris* than other well known drugs. But it is less toxic and more convenient to give, so its use is recommended.

F. Hawking

Vora, D. D. **Treatment of Ascariasis with Intra-Gastric Oxygen. An Analytical Report.** *Indian J. Med. Sci.* 1955, Feb., v. 9, No. 2, 47–51.

Talyzin [this *Bulletin*, 1955, v. 52, 65] described the successful use of intragastric oxygen for the treatment, in the Soviet Union, of large numbers of patients with ascariasis. He claimed that auto-infection with eggs of the worms killed cannot occur, because no larvae develop from the eggs in the intestine of the patient.

Until September 1954 santonin had been the drug used for routine treatment of ascariasis in the Municipal General Hospital, Bombay; but, since then, oxygen treatment has been given to all patients over 12 years old whose stools show *Ascaris* eggs on routine examination.

This paper reports the results of treatment of 33 patients with oxygen. Two of these patients died within 24 hours of the treatment from causes thought to be unconnected with the treatment. Autopsy of the second patient showed that the oxygen treatment had not caused any gross changes in the gastro-intestinal tract.

The ages of the other patients ranged from 12 to over 50 years. After starvation overnight a soap and water enema was given at 6 a.m. No patient passed any worms as a result of this enema. No fluids were allowed after 4 a.m. At 7 a.m. a stomach tube was passed and this was left in for half an hour, the reaction of aspirated material being tested with litmus paper; it was acid in all cases. After the pulse rate had been noted, oxygen was first passed from a cylinder through the Davidson pneumothorax apparatus to measure its rate of delivery; this was usually 100 cc. of oxygen every 15 to 30 seconds. The exit of the pneumothorax apparatus was then connected to the stomach tube and each patient was given 1,000 cc. of oxygen during 2½ to 5 minutes. The stomach tube was then withdrawn. The pulse rate was noted hourly for 8 hours. The morning meal was given, usually 3½ hours after treatment; all patients took it. No purgatives or enemas were given. Stools were examined for the next 4 days.

Of the 31 patients, 20 passed worms (*Ascaris*), 3 passing them on the day of treatment, 1 on the 3rd day after treatment and the rest the day after it. Two patients passed worms on the day of treatment and on the following day. One patient who passed worms on the day after treatment passed more worms on the fourth day. Seven patients passed 1 worm only; the others passed 1 to 10 worms. All the worms except " two expulsions " were dead. [The author does not state how death of the worms was assessed, nor whether stools were examined for eggs of the worms after treatment.]

Six patients had spontaneously passed worms before treatment and five of these were among the 20 who passed worms. Thus 15 out of 26 patients who had not passed worms spontaneously, passed worms as a result of the oxygen treatment.

Eight of the patients stated that they had no reactions to the treatment. Of the others, 13 complained of fulness of the abdomen, 5 of eructations, 2 of nausea, 2 of a desire to pass a stool and 1, a nervous young boy, of dryness of the mouth. The reactions of 3 patients were not noted. Thus fulness of the abdomen was the commonest reaction, but this was not severe and it disappeared in 3 hours. None of the reactions was severe enough to cause cessation of the treatment. The pulse rate showed no appreciable change, except in 2 patients in whom it rose by 12 and 24 per minute respectively after 2 hours, without any other symptoms.

The author concludes that oxygen is the cheapest anthelmintic so far known and it is non-toxic. He calculates that it is, in Indian currency, 38 times cheaper than santonin and 700 times cheaper than diethylcarbamazine. It can be used for a large number of patients and is suitable for mass treatment. It requires neither purgatives nor enemata and can safely be given to pregnant women, to severely anaemic patients to whom santonin cannot be given and to children dehydrated and debilitated by purgation. The author suggests possible modes of action of oxygen on the worms.

G. Lapage

Burch, T. A. & Greenville, H. J. **Filariasis in Liberia.** *Amer. J. Trop. Med. & Hyg.* 1955, Jan., v. 4, No. 1, 47–51.

During the autumn of 1951 a malarial survey of two small villages near Robertsfield, Liberia, revealed that 7·3 per cent. of those examined had demonstrable microfilariae in day blood smears. Subsequently thick blood smears or scarification smears were performed on nearly 2,000 African inhabitants of Liberia. Nearly all were adults except that only school-children were examined in the city of Monrovia. Thick blood films were made so that they would measure approximately 5 × 15 mm. Many of the examinations were done in conjunction with surveys for onchocerciasis with a scarification smear technique. A pilot survey of 12 subjects showed a rapid increase in numbers of microfilariae of *W. bancrofti* between 8 and 9 p.m. The fall commenced about 6 a.m. It was therefore decided to make routine examinations at 9.0 p.m. or as close to that time as possible. The average number of circulating microfilariae found during the night-time was about six times that occurring between the hours of 8 and 10 a.m.

A total of 1,395 African Negroes were examined in Liberia for microfilariae during the day and 520 at night. Forty-two or 3·0 per cent. of the day smears and 53 or 10·2 per cent. of the night smears contained microfilariae of *W. bancrofti*. Six of those examined had *Dipetalonema perstans*. No *Loa loa* were observed. The greatest prevalence and highest microfilariae counts of *W. bancrofti* were found along the coast in Marshall Territory near the Liberian Institute of the American Foundation for Tropical Medicine where 34 or 9·4 per cent. of 362 day and 33 or 16·4 per cent. of 201 night smears were positive. Parasitaemia was much less common in all localities examined in the interior of the country. The incidence of infection among the hinterland tribes who had moved into Marshall Territory was much higher than in their home regions, but only about half that of the coast dwellers and it appears that there has been considerable transmission of the disease in that vicinity, probably dependent upon the

presence in Marshall of the brackish-water breeding mosquito—*Anopheles melas*. This mosquito has a much higher naturally acquired filarial rate than other potential vectors (Gelfand, *Amer. J. Trop. Med. & Hyg.*, 1955, v. 4, 52). This mosquito breeds in the brackish swamps which extend along the entire coast of Liberia. *Philip Manson-Bahr*

Gelfand, H. M. **Studies on the Vectors of *Wuchereria bancrofti* in Liberia.** *Amer. J. Trop. Med. & Hyg.* 1955, Jan., v. 4, No. 1, 52–60. [13 refs.]

This work was done from January 1952 to April 1953 in Marshall Territory in the neighbourhood of the mouth of the Du river about 30 miles east of Monrovia along the coast of Liberia.

Daytime biting mosquitoes are rare in this area. Elephantiasis is uncommon and only a few cases have been seen by the author.

Wild-caught mosquitoes were dissected and examined for the presence of filarial larvae resembling those of *Wuchereria bancrofti*. Laboratory-reared mosquitoes were fed on volunteers who demonstrated microfilariae of *W. bancrofti* in their peripheral blood. The mosquitoes were later dissected to determine the presence of filarial larvae. In the case of the related *Anopheles melas-A. gambiae* complex, egg identification delayed dissection by an average of 2·9 days. Preliminary studies indicated that mature filarial larvae were first present in these anophelines on the 13th day after an infective feed; dissections were therefore done on the 13th and 14th days.

Dissections of wild-caught mosquitoes showed natural infections in *Anopheles gambiae*, *A. melas*, *A. funestus* and *A. hancocki*. No advanced-stage infections were found naturally in any culicine mosquito. *A. gambiae* appeared to be the main vector in the wet season and *A. melas* in the dry season and beginning of the wet season. The dissections showed heavier infections with intermediate stages in *A. melas* than *A. gambiae*.

In the laboratory *A. gambiae*, *A. melas* and *Culex thalassius* were readily infected and able to carry the infection to maturity: but *Culex fatigans* and *Aëdes aegypti* were susceptible to a lesser degree and the cycle tended to be longer than 14 days. Moreover, in the 3 culicines many larvae were unable to complete development. In the 2 anophelines immature and degenerating worms were rarely noted. *H. S. Leeson*

See also p. 740, Muirhead-Thomson, **Factors determining the True Reservoir of Infection of *Plasmodium falciparum* and *Wuchereria bancrofti* in a West African Village.**

See also p. 842, Ball & Clark, **Species Differences in Amino Acids of *Culex* Mosquitoes.**

Jordan, P. **Microfilarial Density and Infection Rates of *Wuchereria bancrofti* and *Acanthocheilonema perstans* in the Southern Province of Tanganyika Territory.** *Ann. Trop. Med. & Parasit.* 1955, Mar., v. 49, No. 1, 42–53, 8 graphs. [12 refs.]

This paper analyses various aspects of a filarial survey in the Southern Province of Tanganyika Territory; the main facts have already been abstracted elsewhere in this *Bulletin* [1955, v. 52, 467]. By grouping the data appropriately, it was found that the microfilaraemia rate (*i.e.*, the percentage of adult males with microfilariae, but without elephantiasis or hydrocele) was roughly proportional to the logarithm of the microfilarial density (*i.e.*, the average count of all the positive blood slides in a village).

This was true both for *Wuchereria bancrofti* and for *Dipetalonema perstans*. In villages where the microfilaraemia rate was 20–39 per cent. or over 40 per cent., the microfilaraemia rate of *W. bancrofti* gradually increased throughout life both in males and in females. But in villages where the rate was under 20 per cent., it increased slowly up to the age of 25–35 years and then showed little further advance with increasing years. Microfilarial counts of over 20 microfilariae per slide were more frequent in the higher age-groups. In the case of *D. perstans* also, the microfilaraemia rate increased with increasing age, and the older age-groups tended to have higher counts. The hydrocele rate was proportional to the microfilaraemia rate, and it also increased with age, being about 3 per cent. in the 16–25-year age-group and about 25 per cent. in the 46–55-year age-group.

In the discussion, it is concluded that the steady increase with age in the microfilarial density of *D. perstans* suggests that there is little or no suppressive mechanism (*e.g.*, acquired immunity) in operation. But the age-density curves of *W. bancrofti* are more erratic than those of *D. perstans* and it is probable that in some cases (especially when elephantiasis occurs) there is some suppressive mechanism which may reduce or annihilate the microfilariae in the blood. In areas where both *bancrofti* and *perstans* are present, there is a significant tendency for people who have one infection to have the other one also. This suggests that some persons may be more susceptible than others to filarial infections [or that they may be more exposed to them]. The higher the microfilarial count the more likely the man was to have hydrocele. On the other hand, persons with elephantiasis seldom (4·3 per cent.) had microfilariae in their blood. Possibly the aetiological processes of elephantiasis and of hydrocele are different. [For detailed data on these subjects the original paper should be consulted.]

F. Hawking

See also p. 839, Marks, **A Review of the *Aedes scutellaris* Subgroup with a Study of Variation in *Aedes pseudoscutellaris* (Theobald). (Diptera: Culicidae.)**

Galliard, H. L'éosinophilie dans les filarioses. [**Eosinophilia in Filariasis**] *Riv. di Parassit.* Rome. 1954, Oct., v. 15, No. 4, 403–23, 2 figs. [Numerous refs.]

This study chiefly concerns eosinophilia associated with *W. bancrofti* and *W. malayi* which live in the lymphatic vessels and tissues, and *L. loa*, which invades the connective tissues, and the microfilariae of which periodically invade the blood.

The exact causes of eosinophilia have not been determined with certainty. The increase of these cells during the acute stages of the infection has led to the belief that these leucocytes are produced in the inflammatory tissues or in the oedematous fluid at the expense of the locally formed histiocytes.

It seems evident that the worm itself has no specific eosinotactic action, but the substances it produces are chemotactic to all types of polymorphonuclear leucocytes. The periodic appearances of microfilariae in the blood-stream have no influence upon the variations in the eosinophilia.

The intensity of eosinophilia is different in various peoples. In Europeans it may be considerable, but it is always lower in Africans, and especially so in Asians. There is no relationship between eosinophilia and microfilariae in the blood, nor between it and the intensity of clinical symptoms. This is especially the case in the elephantiasis of the South Pacific.

A low grade eosinophilia in tropical countries is not due to a parasitic association, a polyparasitism, which exhausts the eosinophilogenic reacting power of the body. What characterizes filariasis in fact is the persistency of eosinophilia at a high level for years even without inflammatory crises.

Tissue eosinophilia characterizes the newly-formed lesions and is due to the death of the adult worms and their microfilariae. A considerable infiltration visible to the naked eye is produced which causes thrombosis and infiltration of the vascular walls and often the formation of eosinophilic abscesses. These phenomena are due to an acute allergic reaction, determined by the disintegration of the worms in hypersensitized persons.

Filarial eosinophilia is sometimes accompanied by a bronchopneumonic syndrome, like asthma, and is of allergic origin.

During specific therapy with diethylcarbamazine variations in eosinophilia occur; this is especially the case in *L. loa* infections when there may be a considerable increase. Corticotrophin has a variable effect on filarial eosinophilia. The irreducibility is specially frequent in Europeans (Thorn's test negative), but in Negroes infected with *L. loa* the results are less marked. Cortisone, on the other hand, produces an eosinopenia which disappears on cessation of treatment. In Negroes, however, irreducibility is often present and this reinforces the belief that there exists a racial difference in eosinophilia, not only in respect of the filariae but also in relation to corticotrophic or cortico-adrenal hormones.

The paper discusses the literature at considerable length.

Philip Manson-Bahr

Kershaw, W. E., Plackett, R. L. & Beesley, W. N. **Studies on the Epidemiology of Filariasis in West Africa, with special reference to the British Cameroons and the Niger Delta. VI.—The Chance of Infection with *Loa loa* incurred by *Chrysops* in feeding on Different Age-Groups of the Human Population in Villages in the Rain-Forest and in the Forest Fringe of the British Cameroons.** *Ann. Trop. Med. & Parasit.* 1955, Mar., v. 49, No. 1, 66–79, 6 figs. [14 refs.]

In a previous paper [see this *Bulletin*, 1954, v. 51, 709] it was shown that a fall in incidence of the infection with *Loa loa* occurred in the human inhabitants in a village on the abrupt forest fringe between the rain forest and the grasslands of the British Cameroons, and the possible mechanisms responsible for this fall were discussed. It was shown in a further paper [*ibid.*, 962] that, though the incidence of infection fell, the pattern of the intensity in the infected persons was not reduced, and these possible differences in the mechanisms of transmission were thus not reflected in differences in the pattern of intensity. It was suggested, therefore, that changes in the pattern of the potential reservoirs of the human infection might have an influence on differences in transmission or be influenced by them.

This present paper discusses the theoretical chance of *Chrysops* sp. acquiring an infection with *L. loa* after feeding on different age-groups of the human population in different types of villages in the rain forest and in the forest fringe of the British Cameroons, as assessed by means of the constitution of the different age-groups in the population and by the concentration of the microfilariae in the peripheral blood in each person.

The most effective potential reservoir of infection for the fly was found to be the middle-aged and elderly inhabitants both of the small villages (which may be regarded as the climax for the human infection) and of the

larger villages in the rain forest, as well as of the villages across the forest fringe where transmission is attenuated and may, in part perhaps, be maintained by another vector. Factors which may modify this concept in natural conditions are considered.

"The significance of these findings in the maintenance of the parasitic complex is discussed, and the conclusion is drawn that the greatest contribution from man to the infection in the fly, and thus to the maintenance of the parasitic complex, is from infections of which the present incidence and intensity are the result of 30–40 or more years' continuous exposure."

R. M. Gordon

Gordon, R. M. & Webber, W. A. F. **A New Technique for the Concentration of Microfilariae from the Venous Blood, and its Application to their Detection in Persons harbouring them in Low Density; together with Observations on the Significance of such Low Densities.** *Ann. Trop. Med. & Parasit.* 1955, Mar., v. 49, No. 1, 80–95, 4 figs. [24 refs.]

A technique is described for detecting scanty microfilariae in large volumes of blood, although it does not give an accurate estimation of their number. A review is given of methods described by other workers. The authors' own method depends upon the use of filters made from stainless steel wire. Living microfilariae of *D. immitis* easily penetrated filters with apertures of 16μ and even vinegar eelworms which measure 70μ across could wriggle through such apertures in a few seconds. However, when the microfilariae had been killed by formalin most of them were retained by the filter.

Blood is taken from a vein and mixed with a few drops of heparin. Nine volumes of distilled water are added to one volume of blood to produce haemolysis. After 2 minutes an equal volume of 5 per cent. formalin is added, and 5 minutes later 9 parts of distilled water are added to one part of the mixture making a final dilution of 1 in 200. The mixture is poured into a 10-inch glass funnel fitted at the bottom end with a rubber tube and screw clip to control the outflow.

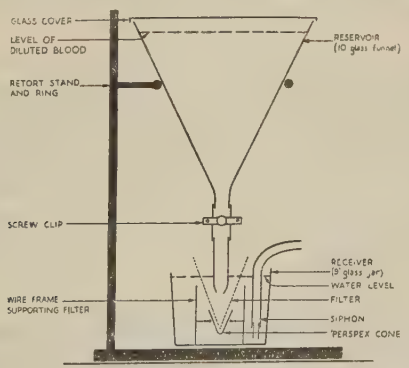

Diagram showing the apparatus assembled for concentrating microfilariae from blood by filtration through a conical filter made of micro-straining fabric

The fluid in the outer part of the receiver is removed by the siphon, so that all the fluid gradually passes through the conical filter which is made of wire fabric with a 23μ mesh. The fluid inside the filter is removed by a pipette

into a centrifuge tube and the filter is washed with 2 ml. water into the same tube. This is centrifuged; the supernatant is removed; uninfected serum is added; the tube is centrifuged again; the supernatant is removed; the sediment is mixed in a drop of serum, and is then spread on a slide to form a thick film. The thick film is dried, fixed in absolute alcohol, and stained in hot haematoxylin for 50 seconds. It is important to clean the apparatus thoroughly with large volumes of water so as to remove all cellular débris which would interfere with its subsequent use. This technique is satisfactory for volumes of blood up to 10 ml. The morphology of the microfilariae is well preserved. When this method was applied to the blood of a dog, shown by direct examination of 50 cmm. to contain 430 microfilariae per 100 cmm., the counts found during 27 tests gave a mean value of 346 $\pm$ 59 microfilariae per 100 cmm., *i.e.* about 50–75 per cent. of the microfilariae were recovered.

This technique was then applied to 0·2–8·0 ml. obtained from blood samples of 65 adult Africans in Nigeria, the results being compared with the direct examination of 50 cmm. of blood as a thick film. In 35 persons no microfilariae were found by either method; in 18 persons they were found by both methods; and in 12 persons microfilariae were found by concentration but not by the thick film. Thus the thick film showed a microfilaria rate of 28 per cent., and the concentration method one of 46 per cent. These persons lived in a part of Africa where exposure to infection by *Loa* is continuous, so that it might have been expected that 100 per cent. of the population would be infected and would show microfilariae. Alhough the former expectation is probably true, the latter one certainly is not.

F. Hawking

See also p. 841, Brown & Morrison, **Studies on Portable Jet Aerosol Generators for Control of Adult Mosquitoes.**

Arends, T., Rondón, M. F. & González Mijares, P. Nuevo foco de oncocercosis humana en Venezuela. Comunicacion previa. [**A New Focus of Onchocerciasis in Man in Venezuela**] *Gac. Méd. de Caracas.* 1954, Nov.–Dec., v. 62, Nos. 11/12, 645–7.

The authors record 2 cases of onchocerciasis in Aragua State, Venezuela. Although the disease had been reported in other regions of the country [this *Bulletin*, 1950, v. 47, 770] this seems to be the first record from Aragua. The State is one of considerable economic importance and it would seem that conditions favourable to the easy spread of the disease exist there. A thorough survey of the extent of the disease, which is evidently more widespread than was believed, is clearly called for and the authors discuss this aspect of the problem.

H. J. O'D. Burke-Gaffney

Jelliffe, D. B. & Sharpe, I. M., with the technical assistance of E. F. P. Jelliffe. **The Incidence and Treatment of Oxyuriasis among Children of British Military Families in Jamaica.** *West Indian Med. J.* 1954, Sept., v. 3, No. 3, 207–10.

The authors examined 106 children of British military personnel attached to Up Park Camp, Kingston, Jamaica. Three Cellophane (Scotch tape) perianal swabs were taken from each child at intervals of 2 weeks.

Of the 106 children, 66 (62·3 per cent.) were positive. The first swab,

taken from 106 children, detected 33 per cent. of positives; the second swab, taken from 62 children, detected 40·3 per cent. of positives and the third swab, taken from 21 children, detected 28·6 per cent. of positives. Of the whole group 23 (21·7 per cent.) had probably had previous treatment. It was noted that, in families of 2 children or more, if one child was positive at the first examination, it was likely that later examinations would show the siblings to be positive also. Thus, of 33 families with one child positive at the first examination, later swabs showed that all the children of 17 of these families were infected.

Treatment was given to all members of infected families, parents and uninfected siblings being included. Instructions were given on the need for general hygienic measures.

The drugs used were gentian violet, Diphenan, Terramycin (oxytetracycline) and Benadryl. All members of an infected family were treated with the same drug. The doses used are given in detail.

Side-effects of these drugs were slight, except occasional colic and loose stools, especially in patients taking gentian violet.

In all, 74 children were treated. It was difficult to follow up the effects, because parents were posted to different stations or went on leave and because patients failed to attend. Three Cellophane swabs were, however, taken 6 to 12 weeks after treatment ceased on the positive children available for re-testing. These showed that of 12 children treated with gentian violet, 3 were still positive; of 10 treated with Diphenan 4 were positive; of 12 treated with oxytetracycline 6 were positive; and of 7 treated with Benadryl 1 was still positive.

The authors conclude, while bearing in mind the small numbers of children treated and the inadequate subsequent examinations, that in this small series none of the drugs tested was very effective. Because the life history of *Enterobius vermicularis* may last, as Schüffner *et al.* [this *Bulletin*, 1951, v. 48, 61] showed, 37 to 93 days, Cellophane swabs taken later would have probably been positive. The authors think that at present no really effective treatment for enterobiasis exists and that, when marked symptoms such as severe pruritus or vulval irritation are absent, it is debatable whether any treatment is necessary. Piperazine adipate, investigated by Standen [*ibid.*, 1954, v. 51, 87] may, they suggest, be more effective. *G. Lapage*

Amato Neto, V. & Corréa, M. O. A. Tratamento da enterobíase pelo hidrato de piperazina. [**Treatment of Enterobiasis with Piperazine Hydrate**] *Rev. Inst. Adolfo Lutz.* São Paulo. 1954, v. 14, No. 1, 39–44. [11 refs.]

The English summary appended to the paper is as follows:—

"The authors treated 23 patients with enterobiasis using piperazine hydrate emulsioned in syrup with orange flavour, 5 cc. of it containing 250 mgm. of the drug. The control of the treatment was made through perianal swabs with cellulose adhesive tape, from the second to the fifteenth day after stopping the treatment, four or five examinations being made in different opportunities. The daily dosage adopted was 60 mgm. per kgm. of body weight, divided into two fractions. The emulsion was dissolved in half a glass of water. Of the 23 patients treated, 18 received two series of treatment, each one lasting seven days, the two series being separated by an interval of seven days; the remaining five patients received only a series of treatment.

"The authors obtained a cure in 21 cases (91·3 per cent.). They emphasize the value of the drug, which gives a high percentage of cure without the necessity of adopting local treatment or specific hygienic measures. In effective doses, the drug does not produce toxic or side effects, it can easily be given to little children and is a low-priced drug."

CHAN, K. F. & BROWN, H. W. **The Treatment of Pinworm (*Enterobius vermicularis*) Infection with Bacitracin and Sulfasuxidine.** *J. Pediatrics.* St. Louis. 1953, Sept., v. 43, No. 3, 290–93. [10 refs.]

The treatment of pinworm [threadworm] infection is not satisfactory, so that any new method is worthy of accurate appraisal. CHAN [this *Bulletin*, 1952, v. 49, 1067] had already had good results with the treatment of the mouse pinworm *Syphacia* by bacitracin and a poorly absorbable sulphonamide; it was therefore decided to treat a number of patients with bacitracin and Sulfasuxidine.

The diagnosis is established by a single application of the Scotch-tape (Cellophane tape) method; 8 post-treatment swabs were taken in a period of 3 weeks, and the criterion of cure was 6 consecutive negative swabs. The swabs were taken by the patient or member of his household.

Two dosage régimes were used, namely:—

Régime I. Bacitracin 10,000 units in 3 or 4 doses and 500 mgm. of Sulfasuxidine in 3 or 4 doses per 10 lb. of body weight daily for 5 days, the maximum or adult dose being based on 120 lb. body weight.

Régime II. Bacitracin 10,000 units and 250 mgm. of Sulfasuxidine per 10 lb. of body weight in divided doses for 7 days, subject to the same maximum.

In the first group there were 6 adults and 11 children, and of these 13 were free of threadworms after treatment, a cure rate of 77 per cent. Of the 4 failures, 3 were cured by a second course of treatment.

In the second group there were 3 adults and 8 children, and all except 1 were cured by the first course, a cure rate of 91 per cent.

There were no toxic symptoms, but several patients had loose motions for a few days. *L. E. Napier*

DEFICIENCY DISEASES

OOMEN, H. A. P. C. **The External Pattern of Malnutrition in Djakarta Toddlers.** *Documenta Med. Geograph. et Trop.* Amsterdam. 1955, Mar., v. 7, No. 1, 1–9, 4 figs. [12 refs.]

See this *Bulletin*, 1955, v. 52, 78 *bis*.

BRAUDE, R., KON, S. K., MITCHELL, K. G. & KODICEK, E. **Maize and Pellagra.** *Lancet.* 1955, Apr. 30, 898–9, 1 fig. [19 refs.]

Eighteen pigs were put on a maize diet, which failed to maintain growth and on which evidence of nicotinic acid deficiency appeared. The animals grew well and kept healthy if either 6 mgm. of nicotinic acid were added daily to the diet, or the bran and hominy meal fractions of the maize (containing 73 per cent. of the total nicotinic acid) were first hydrolysed with

0·5 N NaOH. This well-controlled experiment is consistent with the view that a large proportion of the nicotinic acid in maize exists in a bound form and is not available to the pig. This bound nicotinic acid can be liberated by alkaline hydrolysis.

The pig reacts to nicotinic acid deficiency very similarly to man and it is possible that these factors may explain the relationship of maize to pellagra. The average daily requirement of nicotinic acid by man is usually estimated at 12 mgm. This includes a proportion of bound acid, which may not be available. An amount of 6–8 mgm. of free acid might be a more appropriate estimate of human needs of free nicotine acid.

Alkaline treatment of cereals could be a possible way of enriching these foods.

[All interested in the aetiology of pellagra should read the account of this well-planned experiment and the careful deductions made from the results.]

R. Passmore

Walker, A. R. P., Fletcher, Dorothy C., Strydom, Emmerentia S. P. & Andersson, Marianne. **Food Preparations used in Weaning Urban Bantu Infants.** *Brit. J. Nutrition.* 1955, v. 9, No. 1, 38–41.

Samples of feeds for 77 Bantu children, prepared by their mothers, were analysed. The mixtures included cereal paps, proprietary mixtures of cereals and dried milk and preparations of dried milk. A great majority of the samples were too highly diluted and therefore the concentration of protein and calories was so low that the child could not make satisfactory progress. This factor may be an important contributory cause of poor nutrition so common among the children in South African towns. *R. Passmore*

See also p. 818, Woodruff, **The Natural History of Anaemia associated with Protein Malnutrition.**

Geber, M. & Dean, R. F. A. **Psychological Factors in the Etiology of Kwashiorkor.** *Bull. World Health Organization.* Geneva. 1955, v. 12, No. 3, 471–5.

This is a preliminary report of an investigation sponsored by WHO. The authors state that it is possible to demonstrate a difference between the psychological state of a child seriously ill with kwashiorkor and of a child very ill with malaria, pneumonia or anaemia. In the worst cases of kwashiorkor it is almost impossible for the investigator to establish any real contact with the child. By contrast the child ill with malaria or other diseases welcomes physical contact and comfort. These, the child with kwashiorkor refuses. The mental state of the children was assessed by performances with the Gesell tests, which were repeated throughout treatment.

This withdrawal of the child may be associated with the attitude of the mother or foster-parents. Children may be effectively separated from their mother by the arrival of another child or even by pregnancy. African mothers are often unwilling to play with or fondle their children after weaning. Maternal behaviour may be an important contributory factor in the psychological changes so often found in kwashiorkor. The child may react psychologically by refusing to eat the unsatisfactory diet provided and so a vicious circle of nutritional failure is set up. *R. Passmore*

Stoner, H. B., Davies, J. N. P., Whiteley, H. J. & Emery, J. L. **The Adrenal X-Zone in Kwashiorkor.** [Memoranda.] *Brit. Med. J.* 1955, May 21, 1260.

Gillman and Gillman [this *Bulletin*, 1952, v. 49, 1166] reported that the foetal X-zone of the adrenal cortex persisted in African infants dying of kwashiorkor. Since this would suggest a new approach to the physiology of the X-zone, the present authors were moved, as a first step, to attempt to confirm the observation.

The adrenals from 7 African children (aged 1 to 4 years) who had died of kwashiorkor were compared with adrenals from 19 other Africans dying from various causes and with those from a larger series of English children. There appeared to be no difference in the behaviour of the foetal X-zone in the 3 groups. No evidence could be found that it persisted in kwashiorkor and the rate of its involution after birth was the same in the African adrenals and the English group. It was equally unaffected by systemic disease.

The authors report these negative results as fatal cases of kwashiorkor are becoming infrequent and the claims of Gillman and Gillman have since been reiterated in later reviews. *H. J. O'D. Burke-Gaffney*

SPRUE

French, J. M. **Disorders of Fat Absorption.** *Proc. Nutrition Soc.* 1955, v. 14, No. 1, 33–41, 5 figs. [24 refs.]

The author gives a list of some clinical conditions in which there is steatorrhoea, classified as defective digestion and emulsification, defective mixing and intestinal hurry, defective absorption and " lymphatic obstruction ". The importance of carrying out a minimal 3-day fat balance in every case is stressed and the advantages of continuous fat balance are pointed out, especially since " other events, regarded perhaps as trivial . . . may have . . . an effect upon absorption ". Thus upper respiratory infections in " coeliac " children may depress absorption for days. The application of continuous fat balance technique is discussed in relation to pancreatic insufficiency, coeliac disease, idiopathic steatorrhoea and tropical sprue. Of the possible aetiological factors concerned in the genesis of sprue, the ingestion of rancid fat and the rôle of intestinal bacteria are discussed. The incidence of sprue roughly coincides with the use of certain unsaturated fats such as rapeseed, sesame and mustard oils, all of which are liable to oxidative rancidity.

The virtual absence of sprue in Africa could be correlated with the use of more saturated fats such as palm oil. Sprue almost disappeared from Singapore after the introduction of refrigeration. Diarrhoea, emaciation, anaemia and death occur in rats fed with rancid fats.

French suggests that feeding with rancid fat may cause excessive mucus secretion leading to delay in absorption. The essential functional disturbance in sprue is a generalized delay in absorption from the small intestine. This probably produces a pabulum in the intestine suitable for extravagant growth of intestinal bacteria. In 7 cases of sprue the author, using continuous fat balance as an index of absorption, found that if several chemotherapeutic agents were used *seriatim* over a total of 10–14 days an abrupt rise in fat absorption to normal took place and persisted. He suggests that a cycle of bacterial infection of the gastro-intestinal tract was in this way terminated.

Sprue might start with functional changes in the small intestine initiated by some factor in the diet, for example wheat gluten or rancid fat. Subsequent development of the syndrome might come from the establishment of a bacterial cycle which prolonged the condition indefinitely even when the initial irritant factor had been withdrawn. Appropriate chemotherapy might be useful in such cases. *B. G. Maegraith*

HAEMATOLOGY

Stewart, G. T. **Environmental Factors in Anaemia and Infection in Pakistan.** *Proc. Roy. Soc. Med.* 1955, Apr., v. 48, No. 4, 291–5 (Sect. Epidem. & Preventive Med. 7–11), 2 figs.

In Karachi the author together with a large team examined the haemoglobin levels in more than 1,000 women. In another group of more than 1,000 men and women the faeces were examined microscopically. Hospital in-patients and people who were manifestly ill were excluded from each group and all persons were interviewed to obtain data about housing, size of family, occupation, income, etc.

In the anaemia survey there was a distinct correlation between haemoglobin level and social status. When the women were divided into 5 groups ranging from the wives or daughters of wealthy merchants and potentates at one extreme to the refugee and beggar class at the other, it was found that in groups 3, 4 and 5 more often than not the women were anaemic but that in the more fortunately placed groups 1 and 2 the incidence of anaemia though hardly negligible was significantly less. In group 1 none was found with haemoglobin less than 60 per cent.

There was one interesting anomaly: though the incidence of severe anaemia rose sharply passing from social group 1 to 4, in group 5 there was less anaemia than in group 4. The author has some interesting remarks to make about this. It seems that iron content of the diet is not necessarily related to the income alone and as he expresses it " it seems that in Karachi, you are wealthier in haemoglobin at least, if you are a wife of a beggar . . . than if you are the wife of a craftsman in regular employment . . .". The differences are due to a greater incidence of childbirth between the period of 15 and 30 years in the more settled social strata, and it is also possible that in the lowest social strata among the wives of beggars and unemployed refugees some subtle urban stresses are absent which contribute to the higher incidence of anaemia in the artisan class. On the whole pregnancy was found to increase the vulnerability to anaemia at all ages, though not in all communities because some women are only properly cared for when they become pregnant. Other factors were the purdah observances which were associated with a higher anaemia rate in the more privileged and not in the lowly social classes. Most of the anaemia seen was of the simple nutritional type and in the residue chronic infection such as malaria almost certainly played a large part. True macrocytic anaemia was quite rare accounting for less than 3 per cent. of severe anaemia and none of it was pernicious anaemia.

The second survey was one of faeces and it was found that 18·4 per cent. of 1,348 men and women were carriers of *Entamoeba histolytica*. Another 13·1 per cent. showed indefinite cysts or exudate so that the total

became about 30 per cent. The figure for *Giardia intestinalis* was 8·1 per cent. but for *Ancylostoma* it was surprisingly low, only 1·6 per cent. An analysis of the income groups showed that the infections were widespread at all levels. As the author puts it " freedom from want did not apparently confer freedom from amoebiasis ". In a housing survey it was seen that intestinal parasites were uniformly distributed in the residential suburbs as in the slums. The same applied when the incidence of parasitic infection was related to the number of persons living in a room. *H. Lehmann*

WOODRUFF, A. W. **The Natural History of Anaemia associated with Protein Malnutrition.** *Brit. Med. J.* 1955, May 28, 1297–1307, 15 figs. [40 refs.]

This summary of two Goulstonian Lectures delivered before the Royal College of Physicians of London in 1954 begins with a definition of protein malnutrition. It is not simple protein deficiency, but comprises also disturbances in which underfeeding plays a primary part but where the fully severe condition is brought to its climax by an additional stress such as zymotic agents and infection. This paper deals largely with the severe anaemia of 45 underfed pregnant women. They were seen at hospitals associated with the University College of Ibadan, Nigeria. However, the condition has also been found in early childhood—kwashiorkor—where a special demand of protein is imposed by the growth of the body, and where on weaning a faulty diet consisting largely of starch may fail to do justice to this demand. A series of 9 such children aged from 2½–6 years has been studied. Lastly an investigation of 21 anaemic Nigerian adolescents and adults is described to demonstrate that the condition is not restricted to the two groups primarily at risk—pregnant women and infants taken from their mothers' breast. We have here, therefore, an exhaustive study of 75 anaemic Nigerians which cannot fail to exert a profound influence on our understanding of anaemia in Africa, and of the rôle played by protein deficiency at all ages.

As infections and infestations are a major cause of anaemia in Africa, whether protein deficiency is present or not, careful attention has been given to malaria and intestinal worms. In the 45 pregnant women ova of *Ancylostoma duodenale* were found in 14 and ova of *Ascaris lumbricoides* in 34. Treatment of these infections did not, however, influence the anaemia; furthermore, the characteristics of the anaemia in infected and in non-infected persons were similar. These considerations also applied to the 9 children. None of them showed *A. duodenale* in his stools, and in only two instances were ova of *Ascaris lumbricoides* found. In the group of 21 adolescents and adults, ova of *A. duodenale*, *Ascaris lumbricoides* or *Taenia saginata* were present. However, they were not seen in every person, and when found the infection could be considered slight as only a few eggs were seen in the faeces. As it is unlikely that a light infection with *Ascaris lumbricoides* alone plays an important part in the causation of protein malnutrition or anaemia, and as *Taenia saginata* may similarly be disregarded, the author was able to exclude in 11 of the 21 cases in the third group intestinal parasites as a likely cause of their anaemia. As regards malaria, all adult patients found to have overt malaria were excluded from this study. Ibadan is, however, in a highly malarious region, and the author had to assume past infections in all the patients. Yet though malaria may have played a part in the causation of anaemia and protein malnutrition it could have been only one of the factors which

aggravate the effect of underfeeding. He thus found patients with malarial parasites in their blood frequently failing to improve haematologically when given adequate anti-malarial treatment. On the other hand in well-nourished persons, even when severe anaemia was caused by malaria, the anaemia improved rapidly when antimalarial treatment had been given. In the kwashiorkor group malaria was found twice on admission, but it is accepted from Trowell's work on kwashiorkor in Uganda that the syndrome may occur in the absence of tropical infections [see Trowell *et al.*, this *Bulletin*, 1953, v. 50, 141]. In the pregnant women there was the possibility of yet another stress which might have made an excessive demand on the dietary protein. Whereas in Ibadan hospitals the ratio of twins to other deliveries was 1 in 20, in the 45 anaemic women it was 1 in 5. While this suggests that twin pregnancies may precipitate anaemia, they cannot have been the sole or even a very important cause of the disease in the present investigation.

The deficiency of dietary protein could be fairly accurately estimated from the food brought to the patients by their relatives. As food was not provided by the hospitals it was brought thrice daily from outside, and representative samples for analysis could be obtained, in addition to the weighing and recording of the food consumed. The mean daily protein content of 14 diets (10 pregnant women, 2 non-pregnant adults, 2 adolescents) was 36·4 gm. In the case of the pregnant women this amounted to 11 per cent. of their caloric intake. This contrasts with the figure calculated from accepted international standards which for the pregnant women should have been 77·3 gm. protein per day or 14 per cent. of the caloric intake. There was thus a deficiency of calories in general and in addition, even at this low level, not only an absolute but also a relative lack of protein. In short, the people did not have enough to eat, and what they did consume was grossly deficient in protein.

Important dietary factors other than protein are the B vitamins; but B12, folic acid and liver itself had no therapeutic effect. Indeed the vitamin B12 content of the serum was measured in 5 anaemia cases and was found to be within normal limits.

In 42 of the pregnant women and in all the other patients liver biopsies were obtained. The histological examination showed fatty infiltration in about a quarter of these, and in almost all an increase in fibrous tissue. The overall picture had much in common with that seen in children suffering from kwashiorkor and was similar also to that which can be produced in animals by feeding them on diets low in protein and adequate in carbohydrate or fat. Another aspect of the protein deficiency was a lowered serum albumin with a corresponding rise in globulin. Electrophoretic analysis of the serum protein showed that the increase in globulin was due to an almost three-fold rise in gamma globulin. This was a finding which is commonly associated with hepatic damage. [It is not possible to give the details of the haematological findings in a summary, and the reader must be referred to the original paper.] The most common observation was an increased mean cell diameter, even in most cases classified as microcytic according to their mean corpuscular volume. Larsen (*Acta Med. Scandinavica*. 1948, Supplement 220) found that patients with acute or chronic liver disease had an increased diameter of their red cells but diminished thickness. Similar cells were seen in rats where liver disease had been induced by methionine deficiency (Glynn *et al.*, *Brit J. Exper. Path.*, 1945. v. 26, 326). Reticulocyte counts at initial examination averaged 4 per cent., indicating that the bone-marrow was active. This was borne out by

the bone-marrow picture which was normoblastic. An interesting experiment was performed on the time taken by reticulocytes to ripen *in vitro*. In a number of patients a shortening of ripening time could be demonstrated when the protein deficiency had been treated. There was haemalbumin present in the serum, and malaria may have played a part in producing this sign of haemolysis even in the absence of overt infection [see FAIRLEY *et al.*, this *Bulletin*, 1939, v. 36, 422]. However, haemolytic anaemia has been described in liver disease (DAVIDSON and FULLERTON, *Quart. J. Med.* (n.s.), 1938, v. 7, 43; COLEMAN, *Brit. Med. J.*, 1948, v. 2, 858), and this affords another possible explanation of the haemolysis in these patients.

Protein malnutrition thus being established as the common denominator in all patients, casein was given in daily supplements (50–120 gm. in adults, 50 gm. to infants and young children). In the pregnant women this was followed by a change of the serum protein composition towards normal together with a steady improvement of the anaemia. There was, however, no reticulocyte crisis. A similar unspectacular though steady response was seen in the kwashiorkor infants. Unlike the experience in anaemias caused by deficiencies in specific factors such as vitamins, no rapid haematological response could be expected. In such anaemias a micro-quantity of the deficient factor will restore the missing link in haemoglobin formation, and blood production can return immediately to normal or above normal rate. In protein deficiency the very materials from which haemoglobin is made are defective or absent and this can only be corrected gradually. In addition haemoglobin formation competes for protein with the building up of other body components such as the serum albumin. Woodruff calculates that the protein deficit in the children with kwashiorkor was about 450 gm. Thus a daily dose of 50 gm. casein can hardly be expected to have an effect comparable to that of vitamin B12 in a patient with pernicious anaemia. In the non-pregnant adults treatment was even more difficult than in the other two groups. The reason was that the liver was more damaged. Some patients with particularly advanced liver disease did not respond to treatment at all. *H. Lehmann*

ROSE, J. R. & SULIMAN, J. K. **The Sickle-Cell Trait in the Mende Tribe of Sierra Leone.** *West African Med. J.* 1955, Mar., v. 4 (n.s.), No. 1, 35–7.

The Mende tribe of Sierra Leone forms the largest of the tribal groups in that area. There are about one million of them, of which perhaps one-third live in the adjacent country of Liberia. It is probable that they have lived in their present surroundings for several hundred years as forest dwellers mainly engaged in agriculture. The infant mortality is thought to be about 70 per cent.

Blood was examined after 36 hours of incubation under a coverslip ringed with vaseline. A thousand persons tested were in the following groups: 204 children under the age of two, attending baby welfare clinic; 201 women of child-bearing age attending baby welfare clinic; 191 males and females of all ages attending hospital for any reason; 128 women attending ante-natal clinic; 73 schoolgirls in a secondary boarding school; 70 schoolboys in a primary day school; 57 men employed on building extensions at the hospital, etc.; 76 others.

The average percentage of sickling was 30·6 per cent. In 204 children under the age of two 85 were shown to be positive for sickling. This amounts

to an incidence of over 40 per cent. This percentage falls with increasing age, and among 66 persons above the age of 45 only 12 (18 per cent.) showed the trait. Dividing the numbers examined into two groups—442 children under the age of 16 and 558 persons above this age—the percentage of positive findings was 34·6 in the first group and 27·4 in the second group. The authors also mention that of 300 children admitted to the hospital in 1954, 15 (with 7 deaths) were diagnosed as suffering from acute haemolytic anaemia associated with sickling, whereas of 1,700 adults only 12 (with 3 deaths) were similarly diagnosed. *H. Lehmann*

Edington, G. M. & Lehmann, H. **Expression of the Sickle-Cell Gene in Africa.** *Brit. Med. J.* 1955, May 28, 1308–11, 2 figs. [32 refs.]

It has always been difficult to reconcile the accepted theory of the inheritance of sickle-cell disease with the facts found in Africa. The generally accepted theory is that the gene is harmless in the heterozygote and expresses itself as the trait, but that in the homozygote sickle-cell anaemia is produced. Yet, although the sickle-cell trait is present in 20, 30 or even 40 per cent. of some African communities, the anaemia is rare in adults. This could be explained most easily by assuming an early death of all affected infants. This paper reports that an additional explanation might be a failure of the homozygous condition to cause sickle-cell anaemia in some adults. With the introduction of electrophoretic tests together with solubility measurements it has become possible to determine the genotype of an individual without elaborate family studies. The authors have examined a series of 200 adult Gold Coast Africans and have found two to be homozygous for sickle-cell haemoglobin. Yet though their haemoglobin was chemically indistinguishable from that of persons suffering from sickle-cell anaemia, these two subjects were healthy and not anaemic. On the other hand a sickle-cell crisis with fatal outcome is described in a woman who on electrophoretic analysis was found to be heterozygous for the sickle-cell gene. *H. Lehmann*

Vandepitte, J. M., Zuelzer, W. W., Neel, J. V. & Colaert, J. **Evidence concerning the Inadequacy of Mutation as an Explanation of the Frequency of the Sickle Cell Gene in the Belgian Congo.** *Blood.* 1955, Apr., v. 10, No. 4, 341–50. [32 refs.]

Smith, E. W. & Conley, C. L. **Clinical Features of the Genetic Variants of Sickle Cell Disease.** *Bull. Johns Hopkins Hosp.* 1954, June, v. 94, No. 6, 289–318, 7 figs. [41 refs.]

It is now recognized that certain carriers of the sickle-cell gene in single dose may also chance to carry another gene determining an unrelated abnormality of the erythrocytes. Those who have both genes display many of the features of sickle-cell anaemia (due to the presence of the gene in double dose) but the manifestations are in general much milder. The authors have studied 24 cases and also discuss 19 cases previously reported by others. The anaemia was discovered in childhood in 21 of the 43 patients and even in these normal haemoglobin values were often observed subsequently. The variant group often show haemolytic episodes during which there may be severe anaemia. The target cells are notably increased. Crises similar to those of sickle-cell anaemia occur, but with less frequency. Abnormalities

of the retina were a common finding. Abnormalities of the central nervous system were as frequent and as severe as in the ordinary disease.

J. A. Fraser Roberts

EPIDEMIC DROPSY

Desai, R. A. & Mohile, G. B. **Epidemic Dropsy in Nadiad.** *J. Indian Med. Ass.* 1955, Jan. 1, v. 24, No. 7, 248–53. [20 refs.]

Epidemic dropsy occurred for the first time in Gujarat in June 1953; it appeared in epidemic proportions in Nadiad (Bombay Province), a town of 62,700 inhabitants. About 555 persons were affected. The onset coincided with early monsoon rains that led to extensive pollution of the town's water supply; this coincidence at first led to a misunderstanding as to the nature of this outbreak, but later a closer investigation showed that the disease was not confined to persons using the contaminated water supply. Mustard oil, which is associated with epidemic dropsy in Bengal and elsewhere, is not used to any great extent in Gujarat; the oils used in preparing of food are *til* oil and groundnut oil; many samples of these were found to contain argemone oil, and later extensive stocks of argemone seed were found in the local oil mills.

Ten patients were studied in detail; these patients, 5 males and 5 females, aged 4 to 33, came from 4 families each of which had all or nearly all their members affected.

In each family the onsets of the disease were simultaneous. After vague prodromal symptoms, aches, pains and fatigue, the onset was usually with diarrhoea, abdominal pain, nausea, vomiting and in a few cases blood or mucus in the stools. Oedema first appearing in the feet was constant; in the 2 fatal cases this developed into general anasarca before death.

Erythema, fading on pressure of the lower parts of the body, and fever were also constant; the fever was usually long-continued, irregular and intermittent, but in 4 cases it was of short duration only. Hyperpigmentation of the face and extremities was noted in about half the cases, and several other cutaneous lesions, but not the characteristic nodular lesions.

Most patients had mild respiratory symptoms. Out of 5 patients 4 showed material retinal vascular changes especially the 2 who eventually died, but no glaucoma occurred. Headaches and various neurological changes were noted in a few, and in one fatal case there was neuritis.

Material electrocardiographic changes were found in 6 cases, but there was no constant pattern.

There was hypochromic anaemia of a considerable degree in all cases (red cells 1·68 to 3·75 millions per cmm.) and the sedimentation rate was considerably raised (38 to 105 mm.). A few plasma protein estimations showed a low total but otherwise no material departure from the normal.

L. E. Napier

Shah, M. J. & Lewis, R. A. **Epidemic Dropsy—Nadiad Epidemic. Observations on Serum Proteins and Cortisone Therapy.** *J. Indian Med. Ass.* 1955, Jan. 1, v. 24, No. 7, 245–8, 4 figs. (3 on pl.)

This report consists mainly of a description of a case that occurred in the Nadiad outbreak of epidemic dropsy, with the plasma protein fractionation findings in this and several other cases.

A married woman, aged 35 years, first noticed swelling of her legs; 2 days later she developed diarrhoea, fever, and erythema and pigmentation of the legs. All these symptoms continued and when, 2 months later, she came under the care of one of the authors her fever was of moderately high intermittent type and in addition to the other symptoms she had ascites, an enlarged liver and a characteristic vascular nodule on her face.

Sulphonamides and antibiotics had no effect on her temperature during the first 3 weeks in hospital, but when cortisone—75 mgm. daily in divided doses—was given, the temperature fell to normal immediately and there was a general improvement; within 3 weeks the signs and symptoms began to subside and within 8 weeks had disappeared.

The plasma proteins were estimated by electrophoresis. The total protein was initially 5·12 gm. per cent., the albumin 1·71 gm., alpha globulin 0·27 gm., alpha 2 globulin 0·63 gm., beta globulin 0·83 gm., gamma globulin 1·68 gm. At subsequent examinations after 3 and 9 weeks' treatment, respectively, there was an increase in the total proteins and the albumin and a reduction of the alpha 2 globulin, but no material changes in the other fractions.

The protein-fractionation estimations were carried out in 5 other patients with active epidemic dropsy, 3 convalescents and in 7 students whose families were affected, but who themselves showed no symptoms. The findings in all these cases showed the same tendency to an increase in alpha 2 globulin and a decrease in albumin. [These changes were not nearly so striking and there was statistically no difference between those in the contacts and those with active disease.] *L. E. Napier*

VENOMS AND ANTIVENENES

Ahuja, M. L. & Gurkirpal Singh. **Snake Bite in India.** *Indian J. Med. Res.* 1954, Oct., v. 42, No. 4, 661–86, 1 coloured graph. [19 refs.]

This is a review of the clinical records of 1,231 consecutive cases of snake bite between 1940 and 1953 which are tabulated as follows:—

Table

Mortality rate per 100 bites among 1,231 cases of snake bite by different species of snakes.

Snake		No. of snake-bite cases	No. of deaths	Fatality rate per cent.
Elapidae:				
Cobra (*Naia naia*)		131	11	8·4
Krait (*B. caeruleus*)		35	27	77·1
Species unknown		114	39	33·3
	Totals	280	77	27·5
Viperidae:				
Russell's viper (*V. russelli*)		62	7	11·3
Echis (*E. carinatus*)		58	19	32·8
Species unknown		141	14	19·8 [*sic*]
	Totals	261	40	15·3

Snake	No. of snake-bite cases	No. of deaths	Fatality rate per cent.
Poisonous snakes	541	117	21·6
Non-poisonous snakes	690	–	–
Totals (poisonous and non-poisonous)	1,231	117	9·5

The authors have written an extremely interesting account of snake bite in India, based on the above figures quoted by their institute at Kasauli. They estimate the total annual number of snake bites in India at between 300,000 and 400,000, with an over-all death-rate of about 10 per cent. The maximum incidence of snake bite occurs about July and August when snakes are most active and people sleep mainly out of doors. Bites occurred most often on the hands and feet, fingers and toes in that order. The lethal effect seemed to depend on the position of the bite. The authors suggest that the dose of venom injected depends on the ability or otherwise to fix the lower jaw as a fulcrum. The krait appears to be essentially nocturnal, the bites occurring most often in the dark. Viper bite is commoner in the night than in the day, and cobra bite equally in the night and day. The highest mortality rate was in children under 10.

The diagnosis of snake bite in the absence of the snake may be difficult. In the absence of neurotoxic symptoms measurement of blood coagulation rate may be of considerable value. In the authors' experience " if a patient comes for treatment more than half an hour after being bitten, one can almost certainly rule out viper bite, if the blood coagulates in less than 10 minutes ". It is useful to examine the urine for red blood cells. Their presence is often the first notable sign in viperine poisoning.

Specific antivenene is the only sound treatment. It is most successful when given as early as possible after the bite. In cobra poisoning it is never too late to administer antivenene. Delay in administration is dangerous, especially in viperine poisoning, where changes in the blood and cardiovascular system may occur within a few minutes of the bite although the effects may not become manifest for some hours.

Successful antivenene has been produced in the Institute against the venoms of the cobra and daboia (*Vipera russelli*), but not against krait venom. The relative fatality rates in cobra, daboia and krait poisoning can be seen in the table.

The authors review remedies for snake bite and conclude that the administration of specific antivenene is the only really effective measure. Their own experiments, confirmed by others, have however shown that the injection of a watery suspension of carbolic soap into the region of the bite is effective to some extent in cobra and krait poisoning. They suggest that soap might by a valuable first-aid measure which, although not taking the place of antivenene, might delay the absorption of venom [see this *Bulletin*, 1946, v. 43, 478]. Areas injected may ulcerate. Soap has no effect on the absorption of daboia venom.

The injection of heparin has been shown to help in the case of viperine poisoning, especially when circumstances delay the use of antivenene.

The paper concludes with a very interesting collection of case histories and a discussion of the immediate treatment of snake bite.

[This is a most valuable paper, and should be read by all those interested.]

B. G. Maegraith

Ray, R. & Bhattacharya, K. **Acute Anuria with Vomiting and Haematemesis due to Snake Bite Poisoning.** *J. Indian Med. Ass.* 1955, Apr. 1, v. 24, No. 13, 509–15, 3 figs. (2 on pl.). [13 refs.]

Minton, S. A., Jr. **Polyvalent Antivenin in the Treatment of Experimental Snake Venom Poisoning.** *Amer. J. Trop. Med. & Hyg.* 1954, Nov., v. 3, No. 6, 1077–82. [12 refs.]

The value of antivenene in the treatment of snake bite is often difficult to assess, since the outcome of a bite depends on so many variables, including the toxicity of the venom, the quantity injected, the depth and location of the bite, the response of the subject and the time lapse between the bite and treatment. The administration of antivenene is, moreover, nearly always combined with various first-aid measures, the effects of which are difficult to evaluate in relation to those of the antiserum.

The author points out that it is not economically feasible to produce specific antisera against the 16 known species of rattlesnakes in the United States in addition to the copperhead, water moccasin and coral snakes. In practice polyvalent sera are produced, usually prepared by immunization of horses with a mixture of the venoms of tropical rattlesnake (*Crotalus terrificus*), Maximilian's pit viper (*Bothrops neuweidii*), *fer-de-lance* (*Bothrops atrox*), western diamondback rattlesnake (*Crotalus atrox*) and the eastern diamondback (*Crotalus adamanteus*).

The author describes experiments in which the protective effects of this polyvalent serum were tested in mice against the toxins of 8 North American pit vipers including both diamondbacks, the Massasauga, sidewinder, San Diego and timber rattlesnakes (*Sistrurus cerastes catenatus*, *Crotalus c. lateorepens*, *C. viridis helleri* and *C. h. horridus*, respectively), the Copperhead (*Agkistrodon contortrix mokeson*) and the cottonmouth (*A. piscivorus*).

Doses of 2 × LD50 of each venom were given subcutaneously to female Swiss mice of 15–20 gm. The author considers that this dose roughly approximates to the dose received in potentially fatal cases of snake bite in man. "Antivenin (Nearctic Crotalidae) polyvalent" purchased on the open market and reconstituted was administered in a dose of 5 ml. per kgm. body weight, (a) intraperitoneally 15 minutes before injection of venom, (b) intraperitoneally 15 minutes after venom, and (c) subcutaneously after 15 minutes at the site of the venom injection. Controls received venom only. Deaths within 72 hours were ascribed to the effects of the venom.

Significant protection was obtained against the venoms of the San Diego and sidewinder rattlesnakes, questionable protection against that of the timber rattlesnake and the Massasauga, no protection against the others.

There was little difference in the protection afforded by antivenene given before and after the injection of venom. Intraperitoneal administration of antivenene gave better protection than local injection into the region of the "bite". The author suggests that in the latter procedure some of the antivenene may become pooled or non-specifically bound in the damaged tissues and not be available for neutralizing the lethal effects of the venom. Antivenene did not affect the development of local necrosis.

It is concluded that the polyvalent antivenene studied, if given early and in large doses, has a place in the treatment of bites by rattlesnakes of the *Crotalus viridis* group.

The antivenene, however, did not show protective properties against the venoms of the diamondbacks, which are responsible for most fatalities from snake bite in the United States. Attempts should be made to produce a

polyvalent antivenene covering the venoms of these snakes and of the copperhead and cottonmouth. *B. G. Maegraith*

Schöttler, W. H. A. **Antihistamine, ACTH, Cortisone, Hydrocortisone and Anesthetics in Snake Bite.** *Amer. J. Trop. Med. & Hyg.* 1954, Nov., v. 3, No. 6, 1083–91. [23 refs.]

"The therapeutic possibilities of Phenergan, ACTH, cortisone, hydrocortisone and procaine in snake bite were investigated by subcutaneous application of these drugs in mice and guinea pigs previously or simultaneously injected with venom of *Bothrops jararaca* or *Crotalus terrificus* by the same route. The statistical analysis of the results supplied no evidence of a beneficial effect of any of these substances. Higher sublethal doses of the antihistaminic enhanced the toxicity of *jararaca* venom for mice. None of the tested drugs is apt to replace antivenin in snake bite treatment and the use of antihistamine is even strongly contra-indicated. The significance of these findings is discussed."

Vachon, M. Le scorpion jaune du Pays Ajjer: *Androctonus amoreuxi* (Aud. et Sav., 1812 et 1826) (= *Prionurus eburneus* Pallary, 1928). [**The Yellow Scorpion of the Ajjer Region,** *Androctonus amoreuxi* (*Prionurus eburneus*)] *Arch. Inst. Pasteur d'Algérie.* 1955, Mar., v. 33, No. 1, 54–8, 3 figs.

Barsoum, G. S., Nabawy, M. & Salama, S. **Scorpion Poisoning—its Signs, Symptoms and Treatment.** *J. Egyptian Med. Ass.* 1954, v. 37, No. 8, 857–94, 21 figs. on 10 pls. [45 refs.]

The first section of the paper deals with a study of the physiological behaviour of scorpion toxin in relation to its effect on adrenaline secretion and its action on the autonomic and central nervous system. Scorpion toxin was injected intravenously into anaesthetized and atropinized normal dogs in some of which the adrenals were denervated or excluded from the circulation by clamps. The adrenaline content of the blood and the mean carotid arterial blood pressure were estimated at 5-minute intervals thereafter. In normal animals and those with denervated adrenals there was a rapid rise in both adrenaline and blood pressure, indicating a direct action on the adrenal medulla. Clamping of the adrenals was followed by a fall of adrenaline in the blood; injection under such conditions resulted in a definite but transient rise in blood pressure but only negligible changes in adrenaline level.

The mechanism of these changes was further examined in "high spinal" dogs, and dogs with autonomic ganglia blocked by various chemical agents. In "spinal" dogs injection of toxin led to considerable increase in blood adrenaline, but much larger doses were required than in normal dogs to obtain a rise of blood pressure. In "spinal" animals with clamped adrenals injection of toxin did not affect the blood adrenaline level. Very large doses of toxin were again required to raise the blood pressure in animals with blocked ganglia.

The sympatholytic compound Régitine abolished the hypertension produced by the toxin. Since this drug has no direct effect on the blood vessels, and since there was a gradual rise of blood pressure following injection of toxin

into animals with blocked ganglia, the toxin would appear to stimulate vasoconstrictor nerve endings. Furthermore, fluctuations of heart rate following injection of toxin into "blocked" animals, are abolished by atropine, indicating an action on postganglionic parasympathetic cardiac nerve endings.

The authors conclude that intravenous injection of large doses of scorpion toxin stimulates "all the different autonomic terminations, namely, the preganglionic and the postganglionic nerve endings of both the sympathetic and the parasympathetic systems".

The second section of the paper is concerned with scorpion sting in man and its treatment and also with experiments designed to determine the action of venom on the central nervous system.

In 41 normal subjects the plasma adrenaline content was found to be steady at a mean of 0·005 μgm. per ml. In 36 patients reaching hospital very shortly after being stung, the adrenaline content averaged 0·021 μgm. per ml.; in 6 patients who were examined more than 12 hours after the sting the adrenaline content was 0·011 μgm. per ml.

The authors suggest that the majority of the signs of scorpion poisoning are due to the presence of large amounts of circulating adrenaline and possibly noradrenaline. Sweating is probably due to hypothalamic stimulation because of its association with pallor. Irreversible shock may correspond to "adrenaline shock" seen in animals after massive doses of adrenaline.

Dogs anaesthetized with chloralose were injected with toxin intravenously, subcutaneously, and into the lateral ventricles. Changes in somatic reflexes, blood pressure, respiration, pupil size and the activity of salivary, lachrymal, and bronchial glands were recorded. The effects of subcutaneous injection were somewhat similar to those seen clinically. Significant differences were observed between the effects produced by subcutaneous and other methods of administration. Respiration was increased and deepened in the former case, slowed sometimes to failure in the others. Blood pressure rose only slightly after subcutaneous injection but rose acutely after both intraventricular and intravenous injection. Stimulation of gland secretion was notable after all modes of administration, but developed a long latent period after subcutaneous injection.

Treatment of scorpion sting should be based on an understanding of the mechanisms underlying the various signs and symptoms, *i.e.*, the disturbances of the autonomic and central nervous systems and of the peripheral neuromuscular transmission, and disturbances due to foreign protein. The authors suggest lines of treatment. The parasympathetic stimulation might be controlled by atropine. Most adrenergic blocking agents are too toxic for ordinary use; Régitine is probably the safest effective sympatholytic agent. The effects of the venom on the central nervous system, the most serious of which is respiratory depression, can be countered by the use of respiratory stimulants or artificial respiration. The effects on neuromuscular transmission which give rise to muscular spasms and twitchings can be blocked with Flaxedil, which must however be used with caution against possible interference with respiratory muscles. Shock should be treated on standard lines.

The measures suggested are at present under trial in the Children's Hospital, Cairo. The combination of Régitine, atropine and Coramine is giving promising results. Antitoxin is also under trial.

[The species of scorpions examined and the methods of preparation of the "toxin" used are not described.] *B. G. Maegraith*

Wallace, A. L. & Sticka, R. **The Effect of ACTH on the Toxicity of Spiders' Venom.** *Med. J. Australia.* 1955, Jan. 1, v. 1, No. 1, 5–7, 2 figs.

The authors' report studies on the toxicity of venom of *Lactrodectus hasseltii* and *Atrax robustus.*

Latrodectus venom was obtained as a saline extract of the ground cephalothorax of freshly caught spiders. *Atrax* venom was prepared by "milking" the spiders on a rubber bung and washing off the exuded secretion in saline. The venoms were tested intraperitoneally in mice in which rectal temperatures were recorded by thermocouple.

Two preparations of corticotrophin were used.

A preliminary experiment indicated that corticotrophin administered shortly after *Latrodectus* venom had beneficial effects. Further experiments with groups of 20 mice and an intraperitoneal dose of venom equivalent to the LD50, did not confirm this so far as mortality rates were concerned, the rates being the same with and without corticotrophin.

One of the features of poisoning in mice was a pronounced fall of rectal temperature. The body temperatures were compared in control animals, those receiving toxin and those treated with corticotrophin. In animals which received toxin only the mean rectal temperature after two hours had fallen to 90·8°F.; controls and those treated with corticotrophin developed temperatures of 98·6°F. and 99·8°F., respectively; the initial temperatures were respectively of 100·7°F., 101·5°F. and 101·4°F.

Efforts to perform similar experiments with *Atrax* venom failed. Although the spider concerned is reportedly "more toxic and potentially lethal" to human beings, very few toxic effects appeared in mice either after injection of venom or after actual bite.

The authors consider that their inconclusive results are sufficient to warrant clinical trials of corticotrophin in combination with other therapy in cases of spider bite. *B. G. Maegraith*

TOXOPLASMOSIS

Gustafson, P. V., Agar, Hilda D. & Cramer, Dorothy I. **An Electron Microscope Study of** *Toxoplasma.* *Amer. J. Trop. Med. & Hyg.* 1954, Nov., v. 3, No. 6, 1008–21, 19 figs. on 4 pls. [19 refs.]

The authors point out that, despite numerous studies of stained and unstained preparations of *Toxoplasma*, examined by light, phase and electron microscopy, our knowledge of the morphology of this parasite has not made much progress. In the present paper a description is given of the results obtained from the study of sections of *Toxoplasma* by electron microscopy. For this purpose the peritoneal fluid of infected mice is injected into 0·5 per cent. aqueous solution of osmium tetraoxide, in which the parasites are fixed for 2 hours at 4°C. In the fixative they are found in a flocculent sediment, which is readily concentrated. The sediment is washed and dehydrated in alcohols, and then impregnated in a mixture of 4 parts butyl and 1 part isobutyl methacrylate monomers, after which polymerization in gelatin capsules is carried out at 48°C., and the material is sectioned with a microtome fitted with glass knives. The sections are collected in 50 per cent. acetone water, and transferred to Formvar-coated 200-mesh steel grids. Those not exceeding 0·05μ in thickness were

examined in an electron microscope and photographed at × 3,800, after which enlargements were made.

The results of these observations were as follows. The host cells were represented chiefly by mononuclear cells, but some polymorphonuclears also harboured parasites numbering up to one dozen and enclosed in vacuoles. The parasite is covered by a membrane with fibrillar surface markings. There is no evidence of the presence of flagella or other locomotory structures. At the pointed end of the parasite there is an organelle ("conoid") in the form of a hollow truncated cone, from the base of which are given off about 16 cylindrical bands of different lengths ("toxonemes"). It is suggested that the "conoids" might correspond to the cytopharynx of some protozoa, while the "toxonemes" might be connected with secretory functions. The cytoplasm contains structures suggesting osmophilic inclusions and mitochondria. The nucleus is usually rounded and lies in the middle third of the body. Mitosis was not observed. Since other Protista have not been studied by the same technique, the structures observed in *Toxoplasma* provide no clues to its systematic position.

The paper is accompanied by a series of photographs illustrating the structure of *Toxoplasma*. *C. A. Hoare*

Westphal, A. Toxoplasmoseforschung im Lichte der Malariaforschung. [**Investigation of Toxoplasmosis in the Light of Malaria Research**] *Riv. di Parassit.* Rome. 1954, Oct., v. 15, No. 4, 685–8.

The English summary appended to the paper is as follows:—

"The infection of malaria in human beings is primarily a tissue infection, which had been suspected for a long time. Recently Shortt and Garnham were able to demonstrate it by particular experimental conditions. Such a tissue infection had never been shown by the routine laboratory pathological or parasitological methods. Therefore, the diagnosis of malaria in man is only possible because of the appearance, now and then, of endoerythrocytic parasites from which the gametocytes derive. This classical example shows that microscopical examination of a tissue infection not always may be considered as a true diagnostic basis. The author, therefore, calls attention to the necessity of serologic diagnostic methods in human toxoplasmosis where only tissue infection is possible."

L'Ozach, M. & Vialat, C. Toxoplasmose du chien en France. [**Canine Toxoplasmosis in France**] *Ann. Inst. Pasteur.* 1955, Apr., v. 88, No. 4, 526–8.

After a brief review of canine toxoplasmosis the authors record that on several occasions central nervous tissue of dogs received for the purposes of examination for rabies showed appearances suggestive of toxoplasmosis.

They report one such case in a dog with symptoms suggesting rabies and which had bitten 2 persons. A localized meningitis was found, which did not resemble rabies or other possible virus infections: and there was a very localized infiltration in which toxoplasms were found, free and encysted.

Emulsions of the brain injected intraperitoneally in mice produced toxoplasms in the peritoneal fluid and these increased in number on passage. Not only were typical forms found but also some in binary fission and some tetrads. There were also forms analogous to those described in tissue culture by Chernin and Weller [this *Bulletin*, 1954, v. 51, 978].

The dogs showing suspicious lesions had come from several *départements* and it is clear that infected dogs from these areas may show an encephalitis clinically suggestive of rabies. *H. J. O'D. Burke-Gaffney*

de Rodaniche, Enid. **Spontaneous Toxoplasmosis in the Whiteface Monkey, *Cebus capucinus*, in Panama.** *Amer. J. Trop. Med. & Hyg.* 1954, Nov., v. 3, No. 6, 1023–5. [15 refs.]

The author records, for the first time, a case of spontaneous toxoplasmosis in the Whiteface monkey, *Cebus capucinus*, from Panama. As the animal had been in captivity for some time, the source of its infection could not be ascertained. When first seen the monkey was in a moribund condition. It was sacrificed and examined histologically, when a small pneumonic focus was found in the lungs, but no parasites were detected in the tissues, except the brain, in which a single pseudocyst was seen. Though the blood also revealed no parasites, their presence there was established by successful inoculation of mice, in which the monkey strain underwent 24 passages. In these the parasites showed the same characters and produced the same symptoms as typical *Toxoplasma*. *C. A. Hoare*

de Rodaniche, Enid. **Susceptibility of the Marmoset, *Marikina geoffroyi*, and the Night Monkey, *Aotus zonalis*, to Experimental Infection with *Toxoplasma*.** *Amer. J. Trop. Med. & Hyg.* 1954, Nov., v. 3, No. 6, 1026–32. [16 refs.]

As a rule Primates show a high degree of resistance to infection with *Toxoplasma*. However, the author found that two Panamanian species—the marmoset, *Marikina geoffroyi*, and the Night monkey, *Aotus zonalis*—were highly susceptible. Monkeys of both species were inoculated by different routes (intraperitoneally, intracerebrally, intradermally, intranasally, in the conjunctiva, and *per os*) with a strain recently isolated in mice from *Cebus capucinus* [see above]. All the monkeys developed acute fatal infection, irrespective of the portal of entry of the parasite. At the beginning of the infection only temperature changes were noted, but symptoms developed 1 to 4 days before death, which took place in 3–13 days after inoculation. Parasites in small numbers could be detected in thick blood films within 12–36 hours of death.

Pathological lesions were seen in different organs and tissues, impressions of which revealed numerous free or intracellular parasites, while pseudocysts were only encountered in the conjunctiva of marmosets inoculated by the ocular route. Intradermal injection of tissue fluids containing *Toxoplasma* produced in some monkeys a papule at the site of inoculation, which developed into a vesicle, and later ulcerated. Parasites were found in the fluid of the lesions during life, and in the skin and subcutaneous tissue after death. This local reaction could be neutralized by positive monkey serum, as in the case of the "rabbit skin neutralization test". *C. A. Hoare*

Rodríguez M., J. D. Toxoplasmosis. Experiencias con una cepa de *Toxoplasma* de origen aviario. [**Studies on an Avian Strain of Toxoplasma**] *Rev. Ecuatoriana de Hig. y Med. Trop.* Guayaquil. 1954, July–Sept., v. 11, No. 3, 1–11. [15 refs.]

DERMATOLOGY AND FUNGUS DISEASES

Gudgel, E. F. & Grauer, F. H. **Acute and Chronic Reactions to Black Fly Bites** (*Simulium* **Fly**). *Arch. Dermat. & Syph.* 1954, Nov., v. 70, No. 5, 609–15, 2 figs. [10 refs.]

Of 600 known species of black flies, 15 are found in Japan, the commonest being *Simulium venustum*. Reactions to its bite are common. The small size of the insect and the painlessness of the puncture make multiple bites possible, and when undisturbed the fly will feed for 40 to 60 seconds. It is believed that an anaesthetic anticoagulant is injected at the time of biting. Haemorrhage is severe and the first warning is often a trickle of blood. The normal reaction is a small ecchymosis with a blood crust followed in several hours by a pruritic papule that persists for several days. Erythema, large weals and bruising may, however, occur and other reactions include giant urticarial weals associated with constitutional symptoms, eczematoid lesions, and corymbiform nodular-vesicular plaques or hard verrucoid nodules. The histological changes showed epidermal changes including hyperkeratosis, parakeratosis, serous crust, intracellular oedema with vesicle formation, elongation of rete pegs and papillae. In the corium there was vascular dilatation, oedema and polymorphonuclear perivascular infiltrate. Early lesions showed a high eosinophilia, older ones an increase in mast and small round cells.

The early and immune reactions are discussed and it is considered important to determine the species accurately before checking differences in fly bites. Some species produce no reactions.

Treatments consist of oral antihistaminics, compresses and lotions with elevation of the limb during the acute stage. Later 3 per cent. iodochlorhydroxyquin with 40 per cent. pine tar in Lassar's paste is beneficial and X-rays are effective in hastening the involution of indurated plaques. Prevention is possible by using dimethyl phthalate and other repellents. Four case-histories are given. *H. T. H. Wilson*

TROPICAL OPHTHALMOLOGY

Pagès, R. Conjonctivites folliculaires et trachome. [**Follicular Conjunctivitis and Trachoma**] *Maroc. Méd.* 1954, May, v. 33, No. 348, 461–5.

The author discusses the present confusion in the differential diagnosis of follicular conjunctivitis and trachoma and whether they are one and the same disease. Inclusion bodies are found in both and the eye symptoms will depend on the virulence of the virus. The mild form produces an " acute trachoma " which clears up after 15 days' treatment while the severe form is a chronic disease and takes much longer to cure.

The author is of opinion that the diseases are not the same. An acute form of trachoma does occur but is really the acute stage of the chronic disease and caused by an accompanying secondary conjunctival infection.

In the initial period there is often extreme difficulty in diagnosing these two diseases as the clinical signs may be similar, but as pointed out by Morax a period of at least 3–4 months must elapse before an accurate diagnosis can be made. In the case of trachoma the characteristic signs will then have appeared, in particular, corneal lesions (always absent in

follicular conjunctivitis), the yellow gelatinous follicles and irregularity of the eyelashes. The diagnosis cannot be made by the presence or absence of inclusion bodies. It is probable that there are several groups of conjunctival viruses and these viruses produce the varied forms of conjunctivitis which at present confuse us.

The author discusses the inclusion bodies and other questions and shows in a table the clinical features of the two conditions. *E. W. O'G. Kirwan*

Tsutsui, J. & Takeda, S. Recherches sur le trachome chlamidozoon au moyen du microscope électronique. [**Electron Microscopic Studies on Chlamydozoon Trachomatosis**] *Rev. Internat. du Trachome.* 1955, v. 32, No. 2, 233–46, 2 figs. [13 refs.]

The English summary appended to the paper is as follows:—

"The infective agent of trachoma was purified and it was identified by means of the electron microscope, comparative study to inclusion body, examination of virus potency and chemical treatment of virus-like particle.

"A purification was made in 22 cases of trachomatous conjunctiva by means of differential centrifugation and methanol precipitation.

"The size of this virus seemed to be 50 mmu to 350 mmu. Its shape was spherical but sometimes showed to be cubical, of a comma or a dumbbell form and of diplococcus-like arrangement. This virus made a disciform colony with about 30 of individual virus particles.

"The virus-like particles which were detected by the electron microscope showed a familiar relation with the inclusion bodies. The virus-like particles could be demonstrated only from the follicular type of trachoma cases with a large number of inclusion bodies. The positivity index of virus-like particle and the positivity index of inclusion bodies showed a proportional relation.

"The purified material maintained a potency of virus in limited cases. A potency of virus was not expected in the cases with a small number of inclusion bodies or in cases where the inclusion bodies were absent. In most of the chronic trachoma cases, the potency of virus has been reduced or lost, even in a tenfold conjunctival emulsion.

"The chemical constitution of this virus was considered by means of a chemical treatment and electron microscopy. The central nucleus of this virus seemed to be made from desoxyribonucleic acid and its outer layer [to] be made from ribonucleic acid."

Sie-Boen-Lian. **Poleff's Epithelial Inclusion Bodies.** *Rev. Internat. du Trachome.* 1955, v. 32, No. 2, 177–84, 4 figs.

"Poleff's epithelial inclusions are not identical with the Prowaczeck-Halberstädter epithelial inclusions. Poleff's epithelial inclusions are found in a great part of the trachoma cases (also healed or nearly healed cases), but also even if less frequently in non trachomatous conjunctivitis. Also in cases of normal conjunctiva of adults they are found sometimes.

"In the epithelium or normal conjunctiva of newly born babies they are not to be found.

"Several possibilities are considered to explain recently mentioned facts."

El-Tobgy, A. F. **Recent and Old Conceptions on the Control and Prophylaxis of Acute Epidemic Ophthalmias and Trachoma.** *J. Egyptian Med. Ass.* 1954, v. 37, Nos. 11/12, 1302–8. [12 refs.]

HEAT STROKE AND ALLIED CONDITIONS

Murphy, W. **Some Observations on Blood Pressures in the Humid Tropics.** *New Zealand Med. J.* 1955, Feb., v. 54, No. 299, 64–73, 1 fig. [12 refs.]

The author records observations made during a 6-weeks medical research expedition on the Pacific atoll of Puka Puka. This atoll has an area of just less than 2 square miles and is inhabited by 648 unsophisticated people. The blood pressures of 491 of these persons were measured at the end of general physical examinations. Absence of stress during life and examination were characteristic and the blood pressure readings were consistently below the average range found in temperate zones. Only one local inhabitant had a blood pressure as high as 140/100, the mean ranges rising steadily from 104·5/66·0 at age 15 (male) and 102·6/67·2 (female) to 108·0/65·0 (male) and 112·5/75·8 (female) at ages above 65 years. The diet of the people was largely vegetarian but adequate in calories and protein content.

Morning and evening blood pressures were also determined daily on the 1 indigenous and 4 European workers in the investigating team. In the thermal environment of 79°–80°F. effective temperature combined with great humidity and a lack of breeze, the blood pressures were found to be lower in the 4 Europeans than in a temperate climate. The readings when temporarily excessively lowered were associated with impaired powers of concentration and excessive sweating. Variations and symptoms were greatest in the stoutest member of the team and were more marked in those with least experience of the tropics. During the 6 weeks, acclimatization, as shown by less variation in blood pressure, began to develop.

This is a valuable piece of work recording with accuracy symptoms of fatigue commonly met with by newcomers to a hot humid area and correlating these with temporary lowering of the blood pressure.

Frederick J. Wright

MISCELLANEOUS DISEASES

Patel, B. D. **Eosinophilia in Children.** *Indian J. Child Health.* 1955, Feb., v. 4, No. 2, 49–62. [21 refs.]

The author from Bombay records a study of eosinophilia among 200 children under the age of 14 years. The cases were divided into two groups, one showing higher eosinophil counts (over 2,000 per cmm.), the other counts between 500 to 2,000 per cmm. There were 100 cases in each group. All children in the group with higher counts appeared to be suffering from pulmonary eosinophilia characterized by persistent cough, with or without asthma, anorexia, mottling or increased bronchial markings on X-ray

examination and with usually a good response to arsenic therapy. The incidence of intestinal helminths in this group was lower than in the group with less eosinophilia and removal of the helminths made little change to the eosinophil count or general condition of the patient. In the group with eosinophil counts between 500 to 2,000 per cmm. removal of intestinal parasites gave satisfactory results except in a small proportion where arsenical therapy was successful. Those responding satisfactorily may be considered as cases of Loeffler's syndrome. Corticotrophin was found to be useful in patients with severe eosinophilic asthma and much superior to intravenous TAB therapy which has the sole advantage of being less costly.

In the high eosinophil group the maximum number of cases occurred between the ages of 2 and 10 years. Histamine-fast achlorhydria was observed in a proportion of the patients. The Wassermann reaction was found to be strongly positive but the Kahn test negative in 13 cases in which they were both determined.

[This is a useful article defining the condition of pulmonary eosinophilia in children. The aetiology remains obscure.

Crofton is misprinted Croften and " familial " as " familiar ".]

Frederick J. Wright

Basu, S. P. **X-Ray Appearances in the Lung Fields in Tropical Eosinophilia.** *Indian Med. Gaz.* 1954, Apr., v. 89, No. 4, 212–17, 9 figs. on 7 pls. [24 refs.]

A study was made of the lung X-ray findings in 87 cases of tropical eosinophilia. The skiagrams were all taken at a distance of 72 inches.

An analysis of the findings was as follows: normal, 2; emphysema, 19; increased striations, 59; enlarged hilar shadows, 65; pleural thickening, 3; diffuse mottling, 29; ground glass appearance, 2; snowstorm appearance, 4; minimal infiltration, 7.

In 15 cases a re-examination was made.

The author's observations can be summarized as follows. The X-ray appearances may be normal despite a high eosinophilia and, conversely, mottlings may persist in the absence of eosinophilia. Neither mottling nor striation is dependent on the long duration of the disease. There is in almost all cases a reduction in the extent of the mottling, increased striations and other lesions after treatment, in many there is a return to normal, but in a few the lesions, especially the minimal infiltrations, persist for a considerable time. Scarring after tropical eosinophilia is rare and findings that suggest scarring are probably due to other factors.

L. E. Napier

Wilkinson, J. **A Case of Onyalai in Kenya.** *J. Trop. Med. & Hyg.* 1955, Apr., v. 58, No. 4, 86–9. [10 refs.]

" A case of onyalai which occurred in a Kikuyu tribesman of Kenya is reported, and the 4 cases of the disease which have so far been published from Kenya are briefly analysed." [See this *Bulletin*, 1953, v. 50, 759, 854, 977; 1954, v. 51, 987; 1955, v. 52, 484.]

Jelliffe, D. B. **Acute Toxic Hypoglycaemia in the Vomiting Sickness of Jamaica.** *Indian J. Child Health.* 1955, Mar., v. 4, No. 3, 99–104.

See also p. 847, Hilmy, **The Cheese Skipper as Cause of a Case of Urinary Myiasis in Egypt.**

Chambon, L. Étude de la sensibilité *in vitro* du bacille de Whitmore à la framycétine. [**The Sensitivity of Whitmore's Bacillus to Framycetin** *in vitro*] *Ann. Inst. Pasteur.* 1955, Apr., v. 88, No. 4, 466–71, 1 fig.

Of 32 strains of Whitmore's bacillus, tested by a serial dilution method in tubes, most were inhibited by 25 μgm./ml. of Framycetin [Soframycin Roussel]; 4 strains were inhibited by 12·5 μgm./ml., and 1 strain by 50 μgm./ml. The bactericidal concentration was usually 50 μgm./ml., with a range from 25–100 μgm./ml. No useful synergism was observed between Framycetin and streptomycin, chloramphenicol, aureomycin or oxytetracycline, but there was some synergism with penicillin. With concentrations of 12–16 units/ml. of penicillin and 6–8 μgm./ml. of Framycetin, there was a survival rate of 0·01 per cent. of the organisms.

The effective concentrations of Framycetin are higher than can be attained in the blood, so it does not fulfil the hope that it might be effective in septicaemic cases due to strains resistant to chloramphenicol. However, it may prove useful for the local treatment of accessible suppurative lesions or for pulmonary lesions complicated by infection with *Staph. pyogenes* or *Ps. pyocyanea*, which are sensitive to Framycetin. *J. C. Cruickshank*

PARASITOLOGY: GENERAL

Vanbreuseghem, R. Le parasitisme. [**Parasitism**] *Bruxelles-Méd.* 1955, Mar. 27, v. 35, No. 13, 623–35.

In an inaugural lecture on tropical parasitology at the Université Libre de Bruxelles, the author pays tribute to his great predecessor, Marcel Wanson, and to his two teachers, Gratia and Langeron; the former taught him the value of imagination, the latter technique. Not that Langeron was only a microscopist, his caustic wit was penetrating, *e.g.*, referring to a well-known helminthologist he used to say: "He knows worms to the last degree; but it is necessary to give them to him in alcohol; alive, they disgust him!" [abstracter's translation]. The author ranges over the whole field of parasitology, taking as examples the following: (1) mistletoe on trees, where the tree merely acts as a pipeline to convey primary products like water and salts which are then metabolized by the chlorophyll-possessing parasites, (2) *Leptomonas davidi* of euphorbias, transmitted by the puncture of insects, (3) rust on corn, where the indispensable intermediate host is the common barberry, but where the full cycle is still unknown, (4) the malaria parasite which occupies such different sites in the course of its cycle, but which manages nevertheless to continue on its infernal wheel to the destruction of mankind, (5) *Schistosoma mansoni*, a trematode which passes its life between snails and man, and finally (6) *Histoplasma*, a fungus whose enzymes are so polyvalent that it can live both as a saprophyte in the soil and as an internal parasite of man, or *in vitro* in the widest variety of culture media.

The author then attempts to define the nature of parasitism by stating that it is a mode of life adopted by one living thing, temporarily or permanently, to reside in another where conditions are suitable. If these conditions are made unsuitable the parasite will disappear. It is possible to reproduce such conditions in the laboratory and today many parasites are

kept *in vitro*. Organisms may be " pre-adapted " to new modes of life, and it is such " good mixers " which ultimately become parasites.

P. C. C. Garnham

de Azevedo, J. F., Colaço, A. T. F. & Faro, M. M. da C. Missão de estudo das bilharzioses humanas a Moçambique. Contribuição para o conhecimento das parasitoses intestinais humanas no sul do save (Moçambique). [**Studies on Intestinal Parasites in Man in South Save, Mozambique**] *Anais Inst. Med. Trop.* Lisbon. 1954, Mar., v. 11, No. 1, 121–37.

The English summary appended to the paper is as follows:—

" From the enquiry made regarding the intestinal parasitosis among the inhabitants of the South of Save (Mozambique), the greater number of which were from 6 to 15 years of age, we can come to the following conclusions:

" A)—In the South of Save we must count upon the natives with a large number of intestinal parasites common to man, either the helminths or the protozoa.

" B)—The mean average rate of the global infection through the parasites found, is relatively low varying between 5·5% and 80·99% in accordance with the regions, and averaging a mean total of 52·8%.

" C)—Putting aside the *Sch. mansoni*, the species considered most pathogenic to man are represented there although at low rates: 5·6% for the *Ancylostomidae*, 4·3% for the *St. stercoralis*, 4·1% for the *E. dysenteriae* and 2·9% for the *Lamblia intestinalis*.

" D)—The parasitoses are more frequent from 5 to 15 years of age and vary with sex, in the first years the boys being the most susceptible to the infection and the girls from the 21st year of age.

" E)—The reasons for the relative low incidence of the parasitosis must be traced to the climatic conditions of the region and in the nature of the soil seeing that the dryness of a great part of the region, its sandy soil, and the intensity of the solar rays must make difficult the viability of eggs, cysts and larvae of the parasites in the exterior surroundings."

Ritchie, L. S., Hunter, G. W., Yokogawa, M. & Pan, C., with the technical assistance of J. McConnoughey, Y. Hishinuma, L. Muniz & C. Knox. **Parasitological Studies in the Far East. X. An Epidemiologic Survey of Hokkaido, Japan.** *Japanese J. Med. Sci. & Biol.* 1954, Oct., v. 7, No. 5, 523–37, 1 fig. [10 refs.]

" An epidemiologic survey of intestinal parasites was made in 19 communities of 10 widely separated areas of Hokkaido island, Japan. For a total of 2211 persons, parasites were noted among 86·4%; 79·3% harbored helminths and 48·1% had protozoa. Specific helminths included: *A. lumbricoides* 68·1%, *T. trichiura* 29·4%, *hookworm* 1·9%, *Trichostrongylus* sp. 16·9%, and *E. vermicularis* (by scotch tape swab) 48·4%; the incidence of *S. stercoralis*, *C. sinensis*, *M. yokogawai*, *H. nana* and *D. latum* did not exceed 0·5%.

" Protozoa occurred as follows: *E. histolytica* 10%, *E. coli* 32%, *E. nana* 21%, *I. bütschlii* 3% and *G. lamblia* 6%. The highest incidence of *E. histolytica* noted in this series of surveys (26%) was found at Shizunai among the aboriginal Ainu; otherwise, the incidence ranged from 1 to 15% in the various communities.

" The incidence of ascaris varied from 31 to 93% in the 19 communities;

temperature and moisture were not believed to be factors of difference. Both parasite density index and incidence were lower for the urban population as compared with rural. Probably not more than 9% of all ascaris infections were heavy. It appeared that whipworm infections seldom exceeded a few worms. Since about one-third of the 42 hookworm cases reported no travel outside of Hokkaido, it is believed that a majority of them were autochthonous; in one community far to the north the incidence was 7·5%. On the basis of both incidence and parasite density, pinworm and ascaris seemed to be the important human helminths in Hokkaido. Dooryard gardens, which are repeatedly fertilized directly from toilet receptacles, were recognized as an important factor in maintaining helminth infection levels; they occur commonly except in strictly urban centers."

Cuitiño C., C. Segunda contribución a la Bibliografía Chilena de Parasitologia. [**Second Contribution to the Chilean Bibliography of Parasitology**] 1955. 23 mimeographed pp. Santiago: Biblioteca Tecnica de Parasitologia, Casilla 9183, Chile.

See also p. 817, Stewart, **Environmental Factors in Anaemia and Infection in Pakistan.**

ENTOMOLOGY AND INSECTICIDES: GENERAL ZOOLOGY

[Papers on the toxic effects of insecticides in man are abstracted in the *Bulletin of Hygiene* under the general heading of Occupational Hygiene and Toxicology.]

Australia, Commonwealth of: Commonwealth Scientific and Industrial Research Organization. Division of Entomology. **A Review of Problems of Specificity in Arthropod Vectors of Plant and Animal Viruses** [Day, M. F. & Bennetts, Margaret J.]. 172 mimeographed pp., 4 figs. [Numerous refs.] Canberra: 1954, Mar.

This review attempts to assess from literature on plant and animal viruses transmitted by arthropods what may be significant guides to an understanding and further study of specificity in vectors. Specificity is sharp in some but not in other instances. Lack of specificity is likely and usual when transmission is mechanical, but specific barriers arise when development in the arthropod is cyclical. The problem may well be studied profitably from individuals of varying susceptibility within a competent vector species, apart from comparative work on species of different efficiency as vectors. Causes of specificity are discussed under such headings as ecological factors; feeding habits; the fate of virus in the arthropod gut, blood and salivary glands; and the little-known subject of immunity in insects. No general conclusions are derived. An appeal is made for more enquiry into insect physiology, biochemistry, and immunology. [The points raised by this useful consideration of vector specificity in virus transmission are equally relevant to the unresolved problems of specificity of arthropod vectors of other kinds of pathogenic organisms.] An appendix summarizes facts

known for 37 animal viruses and many plant viruses, naming vectors and tested non-vectors, besides giving data on latent periods, multiplications, transovarial infection and modes of transmission. A list of 700 references and an alphabetical index to plant and animal viruses concludes the text. Four figures illustrate, with simplified sagittal sections of insects, possible mechanisms of transmission of viruses by an aphid, a leafhopper, mosquito and tick. *D. S. Bertram*

Geigy, R. & Herbig, A. Erreger und Überträger tropischer Krankheiten. [**Agents and Vectors of Tropical Diseases**]

This book is reviewed on p. 854.

Williams, C. B., French, R. A. & Hosni, M. M. **A Second Experiment on testing the Relative Efficiency of Insect Traps.** *Bull. Entom. Res.* 1955, Apr., v. 46, Pt. 1, 193–204, 1 fig.

Britz, L. Über die Stechmücken-Fauna (Diptera Culicidae) des Stadtkreises Leipzig. [**Mosquito Fauna of the Leipzig District**] *Ztschr. f. Angewandte Zool.* 1955, No. 1, 61–79, 1 map. [73 refs.]

Bonne-Wepster, J. [M.D.] **Synopsis of a Hundred Common Non-Anopheline Mosquitoes of the Greater and Lesser Sundas, the Moluccas and New Guinea.** [Royal Tropical Institute Amsterdam Special Publication No. 106, Department of Tropical Hygiene & Geographical Pathology No. 20.] pp. vii + 147, 90 figs. 1954. Amsterdam: Houston: London: New York: Elsevier Publishing Co.

This monograph contains under one cover the series of papers published in the *Documenta Med. Geograph. et Trop.*, Amsterdam, and already abstracted in this *Bulletin*, 1955, v. 52, 695.

Iyengar, M. O. T. & Menon, M. A. U. **Mosquitos of the Maldive Islands.** With an appendix by P. F. Mattingly (9–10). *Bull. Entom. Res.* 1955, Apr., v. 46, Pt. 1, 1–10, 6 figs. [13 refs.]

The authors made a large collection of mosquitoes in 5 atolls of the Maldive Islands. As a result of a study of this collection it is now known that the following 15 species occur:—*Harpagomyia genurostris*, *Armigeres obturbans*, *Aëdes aegypti*, *Aëdes albopictus*, *Aëdes* sp. in *scutellaris* group, *Culex minutissimus*, *C. infantulus*, *C. malayi*, *C. spathifurca*, *C. tritaeniorhynchus*, *C. vishnui*, *C. sitiens*, *C. fatigans*, *Anopheles subpictus* and *Anopheles tessellatus*. Notes of taxonomic interest are given on 7 of them some of which are further elaborated by Mr. Mattingly in the Appendix. *H. S. Leeson*

Lane, J. **Neotropical Culicidae. Volumes I & II.** 1112 pp., 1072 figs. 1953. São Paulo: University of São Paulo, Brazil. [£5 12. 6.]

This is the first comprehensive treatise on the neotropical mosquitoes to appear since the publication of Dyar's *The Mosquitoes of the Americas* in

1928 [this *Bulletin*, 1929, v. 26, 514]. As such it is indispensable for those interested in the medical entomology of South and Central America and the West Indies. It is a descriptive monograph, in English, with only a very brief general introduction. The labour involved in its compilation has clearly been very great and for this Professor Lane has earned the gratitude of all concerned. It is to be regretted that in producing this valuable book time could not have been found for removing certain obvious blemishes. The text figures require to be placed in proper numerical order and some of the keys contain structural faults which render them unusable in their present form. Less easily detected are the rather numerous errors in the citation of the provenance and present whereabouts of type specimens. Such errors can cause serious trouble, especially where lectotypes or neotypes are being published for the first time, and this part of the book needs particularly careful revision. It is to be hoped that these faults will eventually be rectified in a second edition. Many will also hope that when this appears the bibliography will be in one piece and not, as at present, in a number of sections which are inadequately cross-indexed.

P. F. Mattingly

Marks, Elizabeth N. **A Review of the *Aedes scutellaris* Subgroup with a Study of Variation in *Aedes pseudoscutellaris* (Theobald). Diptera: Culicidae.)** *Bull. Brit. Mus.* (*Nat. Hist.*). Entom. Ser. 1954, v. 3, No. 10, 349–414, 19 figs., 1 map & 1 folding pl. [Numerous refs.]

The *scutellaris* group in the sub-genus *Stegomyia*, which is itself a component of the great genus *Aëdes*, is familiar to workers in tropical medicine. They know also of Miss Marks's recent critical work on some of these insects and will remember that she was compelled to separate a new species, *Aëdes polynesiensis*, breeding from Fiji and the Ellice Islands eastwards to the Marquesas and Tuamotu Islands [this *Bulletin*, 1952, v. 49, 168]. The *scutellaris* group as a whole exists from this eastward limit westward to the Andamans and north as far as Okinawa.

Miss Marks here gives a full account of these insects, presenting her results in two parts of about equal length. The first is taxonomic: in it she defines and illustrates a number of points in which they differ from one another. She finds that there are in all 18 entities, all of which she prefers to regard as species. A key and an ingenious plate are provided giving comparative illustrations of all, and showing that on the whole there is a trend from west to east in certain characters. So far as possible Miss Marks calls attention to what is known about the differences in larvae existing between the different species. It is hardly possible to summarize this part of the paper.

In the second part the author describes experiments on a single species in order to investigate the extent to which special morphological characteristics of the adults "could be affected by controlled variations of the larval environment". In this study she worked on 2 strains of *A. pseudoscutellaris* derived from Fiji, available in England. Apart from differences in male genitalia, nearly all the morphological points which she wished to study were based on differences in the distribution of black and white scales, so that they were to that extent simple to measure and record. A large number of small but apparently significant differences were produced by altering the temperature or salinity of the water in which the larvae were kept. Without going into these matters we may quote here general conclusions that:—"Size of adults decreases with increase of temperature

or salinity of the larval environment. In general, the amount of white scaling increases with rise in temperature; conversely the amount of dark scaling increases with fall in temperature."

[Mosquitoes of the *scutellaris* group may well come to supply the material for extremely valuable research in the future. There is a large number of very similar species nearly all found in isolated areas. The insects are easy to rear and maintain and the eggs survive dry and may be posted about the world. So far as we know there is a considerable measure of fertility between species.] *P. A. Buxton*

Day, M. F. **The Mechanism of Food Distribution to Midgut or Diverticula in the Mosquito.** *Australian J. Biol. Sci.* 1954, Nov., v. 7, No. 4, 515–24, 2 text figs. & 6 figs. on pl. [20 refs.]

This work is a study of the mechanism in mosquitoes which is concerned in the dispatch of solutions of sugars to the diverticulum and of blood to the midgut. The species used was *Aëdes aegypti* and as liquids were frequently found in the ventral diverticulum and gas in the dorsal pair, the ventral diverticulum alone is considered in these results.

The addition of a small amount of blood to 10 per cent. glucose solution resulted in the mixture going partly to the midgut and partly to the diverticulum. Even one part of blood to 20 of glucose was detected and activated the "switching mechanism". Some other sugars were detected but lactose seemed unable to stimulate the receptors. Plasma and erythrocytes were detected but the reaction to plasma was not so marked. Washed red cell membranes also activated the switching mechanism.

Experiments suggest that two types of sense organs might be necessary to detect both sugar and blood. The dorsal and palatal papillar sense organs situated in the buccal cavity of both sexes all receive nerves from the frontal ganglion.

It is suggested that certain sugars stimulate the pit organs in the buccal cavity causing relaxation of the sphincters of the diverticulum and certain components of the blood stimulate the papillar sense organs relaxing the cardiac sphincters.

In nature the opportunity to bite a suitable host comes at irregular intervals so the insect must be able to utilize the opportunity when it occurs. Nectar is more generally available and is sufficient to keep the insect alive. But the ability to take a blood meal in spite of a recent nectar meal would seem to be of survival value. This is accomplished by the switching mechanism so that a crop containing some nectar does not preclude the taking of a blood meal should this become available. *H. S. Leeson*

Altman, R. M. & Smith, C. N. **Investigations of Repellents for Protection against Mosquitoes in Alaska, 1953.** *J. Econom. Entom.* 1955, Feb., v. 48, No. 1, 67–72.

"Field tests with mosquito repellents were conducted in Alaska in June and July 1953 against mixed populations of *Aedes communis* (DeG.), *A. punctor* (Kirby), *A. excrucians* (Wlkr.), *A. fitchii* (F. & Y.), *A. stimulans* (Wlkr.), *Culiseta impatiens* (Wlkr.), and *C. alaskaensis* (Ludl.). Tests were made with 15 individual repellents and 12 repellent mixtures for application to the skin, and with 44 repellents and six mixtures for application to the clothing.

"Because of the long protection periods obtained with repellents applied

to the skin at full strength, comparisons were made of the biting rate at very low concentrations (1·25, 2·5, and 5 per cent) in ethanol and of the protection period at 5 to 25 per cent.

" Clothing repellents in acetone or gasoline solutions were applied to cotton stockings, which were tested after 1 to 6 days of aging, and 16 days of aging plus 5 minutes of rinsing.

" The five most effective individual repellents for application to the skin skin were *N*,*N*-diethyl-*m*-toluamide (20218); *o*-ethoxy-*N*,*N*-diethylbenzamide (20297); *o*-chloro-*N*,*N*-diethylbenzamide (17586); citral-malonic acid condensate 1(20023); and propyl *N*,*N*-diethyl-succinamate (6168). The three most effective mixtures (M-2043, M-2072, and M-2074) each contained 40 per cent of dimethyl phthalate (262), 30 per cent of 2-ethyl-1,3-hexanediol (375), and 30 per cent of *N*,*N*-diethyl-*m*-toluamide (20218), *o*-ethoxy-*N*,*N*-diethylbenzamide (20297), or propyl *N*,*N*-diethyl-succinamate (6168).

" The four lotions containing 40 per cent of repellent were about equal to full-strength repellent mixtures.

" The three most effective individual repellents for application to clothing were hendecenoic (undecylenic) acid (2065), 1-butyl-4-methylcarbostyril (7627), and amyl mandelate (20127). The best mixture (M-2040) contained 30 per cent of hendecenoic acid (2065), 30 per cent of *N*-butyl-4-cyclohexene-1,2-dicarboximide (4145), 30 per cent of *N*-butylacetanilide, and 10 per cent of emulsifier (Tween 80)."

Brown, A. W. A. & Morrison, P. E. **Studies on Portable Jet Aerosol Generators for Control of Adult Mosquitoes.** *Mosquito News.* 1955, Mar., v. 15, No. 1, 1–12, 4 figs.

These studies are an extension of tests already reported [this *Bulletin*, 1953, v. 50, 1171], and are concerned with tests of portable jet aerosol generators having emission rates of 2 to 9 gallons per hour (g.p.h.). Determinations were made of the droplet spectra, the amounts of insecticide reaching various distances down wind, and the effectiveness against adult *Aëdes* mosquitoes in woodland at dosages similar to those employed with the larger machines.

Two portable machines were tested:— (1) the Swingfog Pest Control Unit weighing 24 lb. empty and 34 lb. filled. This machine has a tank capacity of 1 [imperial] qt. gasoline sufficient for 1 hour's operation. Another tank holds 3·5 imp. qt. of insecticide. (2) The Dyna-Fog Jr. Jet Insecticidal Fog Generator weighs 15 lb. empty and 33 lb. filled. The gasoline tank holds 1·6 imp. qt. sufficient for 55 minutes and the insecticide tank holds 1·5 imp. gal.

The insecticides used in the tests were various formulations of DDT. The methods of conducting the tests and the results obtained are described in detail. The data are tabulated and are shown on graphs, the main operational data being given in a summary.

The Swingfog apparatus can emit aerosols suitable for controlling woodland mosquitoes. It gives control equal to that obtained with the TIFA which requires a vehicle and roads. The smaller orifices are a handicap in woodland, larger ones are probably economical. The lighter construction of the Dyna-Fog Jr. makes it less suitable for rough conditions in woods. DDT aerosols at 0·16 to 0·36 lb. per 100 yd. frontage eventually kill or hasten the death of adult blackflies (*Simulium* spp.) but the dosage is insufficient to kill them in a short time. From experience it may be said that such dosages suitable for mosquito control achieve on the average a one-third

reduction in landing rate of blackflies which may range from three-quarters reduction to no reduction at all. *H. S. Leeson*

Ball, G. H. & Clark, E. W. **Species Differences in Amino Acids of *Culex* Mosquitoes.** Reprinted from *Systematic Zool.* 1953, Sept., v. 2, No. 3, 138–41. [12 refs.]

The authors carried out an analysis by paper chromatography of the free amino acids present in whole specimens of *Culex quinquefasciatus* [*fatigans*].

The bodies of 40 starved mosquitoes were homogenized and deproteinized with ethanol. After filtration, the resulting liquid was reduced to a usable volume and applied to the paper.

The results agreed with previously published results of analyses of the same species by other authors [this *Bulletin*, 1952, v. 49, 451, 807].

Two other species, *Culex tarsalis* and *Culex stigmatosoma* were also analysed by identical techniques, and the results compared with those of other workers.

Variations of amino-acid pattern on the chromatograms are attributed to actual specific differences, and not to variations in technique or to geographical or ecological factors. *J. S. Harington*

Hosoi, T. **Egg Production in *Culex pipiens pallens* Coquillett. V. Relation to Fattening and Biting Activity.** *Japanese J. Med. Sci. & Biol.* 1954, June, v. 7, No. 3, 231–40. [19 refs.]

In this paper an attempt is made to explain the relationship between biting activity and active growth of the ovarian follicles. The first group of experiments was carried out on mosquitoes raised at temperatures varying from 6–17°C., but maintained for 7 days before experiment, in 4 lots, at temperatures from 18–28°C. The experiments illustrate the effect, on subsequent blood-feeding, of a previous sugar feed and of starvation, and of conditions of light and darkness. Starved mosquitoes were found to take a blood meal most readily, and illumination of starved females still further increased their biting activity. In general, light conditions were shown to increase the rates of metabolism of both sexes and to raise excitability.

A difference in behaviour was noticed in females which had been fed on mouse blood and those fed on human blood. In the first case, no further blood meal took place until after oviposition, but in the second case, females commonly fed again even while blood from the first meal remained in the stomach.

Abdominal ligatures and ovary transplants did not reveal any evidence of secretion of a hormone by the developing ovaries which might directly affect the biting activity, despite the apparent correlation between biting activity and capacity for egg formation. *Anne Hudson*

Gersdorff, W. A., Mitlin, N. & Nelson, R. H. **The Comparative Effect of a Sulfone in Pyrethrum and Allethrin Mixtures as House Fly Sprays.** *J. Econom. Entom.* 1955, Feb., v. 48, No. 1, 9–11.

"The comparative effect of a sulfone in oil sprays containing either allethrin or pyrethrins in the proportion of five times as much adjunct as

insecticide was determined in tests against the house fly, *Musca domestica* L., by the turntable method.

"The sulfone synergized both insecticides, pyrethrins much more powerfully than allethrin. The relative toxicity was 12·9 as much as expected in the mixture with pyrethrins and only 2·2 as much in the mixture with allethrin.

"The relative effectiveness of the insecticidal materials was rated as follows, whether the evaluation was based on insecticide content only or on insecticide equivalent: pyrethrins (1), allethrin (3), allethrin plus the sulfone (7), and pyrethrins plus the sulfone (13).

"Knockdown of flies was high in all sprays containing the insecticides. The sulfone alone caused relatively little knockdown and mortality."

METCALF, R. L. **Physiological Basis for Insect Resistance to Insecticides.** *Physiol. Rev.* 1955, Jan., v. 35, No. 1, 197–232, 2 figs. [187 refs.]

This is a valuable review of resistance in insects to modern insecticides. It is up-to-date, based on nearly 200 references, and contains useful tables of comparative data. A graph shows the rates of development of resistance by house-flies to several insecticides, and there is a chart of the chemical structure of several compounds involved in DDT-resistance. Much of the information reviewed is about *Musca domestica*, since most of the critical laboratory work on insecticide resistance has been done with this insect, and the house-fly, more than any other pest, created the urgent realization that this phenomenon is an important challenge in practical hygiene. Nevertheless, resistance is also now known in bedbugs and lice, and is reported for some mosquitoes besides agricultural pests and ticks of veterinary interest. Indeed, it is by no means a new thing, the first case of this kind being that of a scale insect becoming resistant to cyanide fumigation as long ago as 1913. Original papers providing the substance of this article have been extensively reported in this *Bulletin*, but this review provides perhaps a suitable opportunity to attempt a connected abstract of this interesting, important and intricate subject.

It is generally agreed that resistance to insecticides, as so closely studied for the house-fly and the chlorinated hydrocarbons and other compounds, arises by selection of a number of naturally occurring genes each conferring some resistance to the insecticide. With *Musca* there is both field and laboratory evidence that resistance develops rather slowly (2–3 years in the field or 20–30 generations in the laboratory) while selective processes concentrate these genes into the cytological equipment of the survivors of the fly population. Later, the rate of intensification is more rapid until resistance amounting to immunity results (a few months in the field or 6 to 20 generations in the laboratory). The initial slow phase is one of multiple gene rearrangement and concentration, and the rapid phase which follows is, it is thought, due to the process being controlled by a single pair of genes. The effect of this pair is probably obscured at first by its association with low fertility. Resistance up to 5- to 10-fold in the first slower phase would attain 100- to 1,000-fold in the shorter second phase. Exposure of larvae as well as adults to contact would increase the rate of development of resistance.

Resistance as considered in this review is mainly resistance to kill but it is noted that in one house-fly strain, a separate entity, resistance to "knockdown" has also been detected. Apart from this, resistance to kill which is the usual manifestation experienced in the field and studied experimentally is, even within the limits of the house-fly alone, not a simple

problem. Resistance of house-flies to DDT was the first realization of the problem in the field and it was followed, surprisingly quickly (within a few months in some cases), by resistance to substitute insecticides used instead of DDT, such as lindane (≡ gamma BHC), chlordane, toxaphene, methoxychlor or dieldrin. Fly populations made resistant to some or all of these insecticides by successive exposure to them separately are said to exhibit *multiple resistance*. This has happened in several European and Mediterranean countries, Central and South America, Canada and the U.S.A. but is not yet reported from India, Ceylon or Japan where even DDT-resistance is not yet material despite its use for 5–6 years. It is thought that the rapid onset of resistance to these substitute insecticides may be explained by the fact that the initial slow concentration of genes favourable to resistance has already been accomplished during the treatment with the first insecticide used, usually DDT, so that the second, rapid, phase of intensification comes into action at once and rapid development of substantial resistance to the substitute insecticide ensues.

An even more interesting but disturbing fact is that of *cross resistance* by which is meant that flies made resistant to one insecticide by exposure solely to it are found to have developed also some degree of resistance to other insecticides which they have never experienced. There is, however, a logical pattern in this which is not only intrinsically interesting but an instructive warning for future practical policy. Thus (as a table shows) house-flies resistant to DDT are also markedly resistant to related analogues such as DDD and methoxychlor, this series being grouped together as group I. There are six further groups. In group II are the well-tried insecticides lindane (≡ gamma BHC), heptachlor, aldrin, dieldrin, toxaphene and chlordane and the flies made DDT-resistant by contact only with DDT will also have a slight resistance to these group II insecticides. Slight resistance will also be developed by these flies to the nitroparaffins Bulan and Prolan (group III), to the organic phosphates like parathion (group IV) and to pyrethrins and allethrin (group V). But the organic thiocyanates, thanite and lethane (group VI), remain fully effective, as also is Pyrolan. Furthermore, flies made resistant to a group II compound by sole contact with it will be at once substantially resistant to all the other compounds of that group but less so to group I (DDT and its allies) and barely so to insecticides of groups III to VI. Resistance does not readily develop in house-flies to the organic phosphates (parathion, etc., group IV), nor, although it is known, is cross resistance to other groups very marked. Similar relationships of cross resistance are noted for American species of *Aëdes* and *Culex*, *Blatella germanica*, *Pediculus h. corporis*, and *Boophilus decoloratus* besides agricultural pests. There is evidence that molecular configuration is important as a key to these groupings and their interrelationships in resistance.

An earlier belief in practical hygiene that changing the insecticide used would defeat resistant populations is, therefore, as events have already shown, seriously jeopardized. And it was also thought, on good evidence at the time, that resistance to the discarded insecticide would revert until the fly population was again highly susceptible to it and it could be reintroduced. It is true that reversion of DDT-resistance does tend to occur (at least with house-flies) but it may be a very slow process (35 or more generations or 18 months in one field test) before it is first apparent and it has not been known to go on to normal susceptibility. Moreover, it is known that lindane, dieldrin and also parathion have, as substitute insecticides, heightened DDT-resistance rather than allowed the flies to recover their susceptibility during its disuse.

As regards factors associated with resistance there are sometimes minor morphological differences between susceptible strains (S-flies) and resistant strains (R-flies) of house-fly but neither these nor some biological differences affecting reproductive potential and duration of life cycle are considered to be important in causing the phenomenon of resistance. However, abnormal behaviour or habits after experience of an insecticide may well contribute to lack of success with an insecticide as a practical measure of control. Irritability or contact repellence are commonly invoked as the basis of this behaviouristic resistance.

The paper then examines the biochemistry of resistance. It is clearly not a question of the relative thickness of cuticle in S-flies and R-flies, but one of degradation and metabolic cycles of the insecticide in conjunction with enzyme systems, a field of study which is really only adequately explored as yet for DDT in the house-fly in both susceptible and DDT-resistant strains (S-flies and R-flies, respectively).

The essential story, as it is at present understood from a substantial amount of study by numerous workers, may be outlined as follows: R-flies degrade DDT to a non-toxic metabolite DDE (2,2-bis-(*p*-chlorophenyl) -1, 1-dichloroethylene) besides also an unidentified substance X. This detoxification process is a dehydrochlorination of DDT to DDE (mainly) through the agency of a dehydrochlorinase system. This mechanism has also been demonstrated for the larvae and pupae of R-flies. The dehydrochlorinase has been abstracted from R-flies but not from S-flies, although it is not wholly absent from S-flies as shown by other tests and estimations. A fundamental difference then between R- and S-flies is the marked ability of the former to detoxify DDT to these non-toxic metabolites, particularly DDE. In passing, we may note that treated larvae and pupae take up DDT but it is not until emergence that lethal effects become manifest—at least at dosages comparable to effective doses for adults of the same strain.

Analysis of fly tissues to locate the site of DDT metabolism and action indicates that considerable quantities are stored harmlessly in lipoid tissues and that the hypodermis may be the site of detoxification of DDT. Some workers, using bioassay methods, trace the passage of DDT through the cuticle to the haemolymph, into the nervous system, with final excretion by the Malpighian tubes and hindgut. Although disparities exist in the results by different workers there are grounds for concluding that in normal flies the DDT is stored harmlessly in lipoid tissues and diffuses slowly to the sites of its poisonous action but that in R-flies it is metabolized to non-toxic DDE during this slow diffusion. Oxygen consumption of S-flies poisoned by DDT is 3 to 5 times that of untreated flies and is related to their hypersensitivity and a great depletion of stores of glycogen, glucose, phosphoarginine, pyruvic acid and non-protein nitrogen. Oxygen consumption and depletion of energy reserves is, on the other hand, much more normal in R-flies. There is evidence of inhibition by DDT, its analogues and synergists, of the cytochrome oxidase, succinoxidase and succinic dehydrogenase enzyme systems, but not of cholinesterase activity. In R-flies the cytochrome oxidase system and a cyanide-insensitive respiratory system (possibly a flavin) were more active than in S-flies and these respiratory channels may, perhaps, be vital factors in the survival of R-flies.

DDT synergists have been studied both as a tool of enquiry and as a possible means of overcoming the practical issues of DDT-resistant fly populations. Piperonyl cyclonene, one of the pyrethrin synergists, proved effective by delaying dehydrochlorination of DDT to DDE but it was not suitable for practical development. In extensive tests of over 2,000 other

substances a few proved promising, particularly DMC (1,1-bis-(*p*-chlorophenyl)-ethane) which is related to DDT and gave optimum effect on R-flies at 1 pt. DMC to 10 pts. DDT. This synergist appears to act by competing with the DDT molecule for the DDT dehydrochlorinase enzyme which, in R-flies, converts DDT to non-toxic DDE. Some DDT therefore remains unchanged as it diffuses to the site of its action and toxic effects result. The DMC is dehydrated to DME which is subsequently excreted via the Malpighian tubes and hindgut as DDA. There are structural similarities in the molecular form of DDT and DMC to justify this conception of their competition for a specific enzyme system.

Less is known to explain resistance to other insecticides but some mechanism of detoxification is probably involved with lindane, toxaphene. and chlordane.

From the viewpoint of the control of the house-fly—and other insect enemies of man—there is, of course, need to solve this problem of resistance to modern insecticides. The principle to be preferred is prevention rather than reversing or counterbalancing it by substitution of other insecticides. procedures which, as can be understood from this paper, have already failed in practice. Nevertheless, much useful guidance and inference can be drawn from our present understanding of the problem. Thus, treatment could be advised with mixtures of insecticides or, preferably, alternating treatment programmes with separate insecticides, provided always that they are independent and unrelated in their action so that the rapid build up of multiple resistance or the more fundamental cross resistance is avoided. The classification of insecticides into groups I to VI is a valuable key in this respect. The chlorinated hydrocarbons (groups I and II) are particularly prone to induce multiple resistance and cross resistance, especially group II. But the lesser tendencies in this way of other groups have directed current experimental work to exploring the practicability of the pyrethrin group (V) and organic phosphorus compounds (group IV) like parathion, malathion, Diazinon, chlorthion and EPN as insecticides for the future.

The review concludes on the theme that notable resistance may perhaps always remain, fortunately, the exceptional event, since only 0·1 per cent. of over 5,000 economically important insect species have so far shown this tendency to a material degree. *D. S. Bertram*

Ascher, K. R. S. **Insect-Resistance to Dieldrin. A Survey of the Literature.** *Riv. di Parassit.* Rome. 1955, Jan., v. 16, No. 1, 31–40. [Numerous refs.]

Brown, A. W. A. & Morrison, P. E. **Control of Adult Tabanids by Aerial Spraying.** *J. Econom. Entom.* 1955, Apr., v. 48, No. 2, 125–9, 2 figs.

" Laboratory and field tests were made of lindane, DDT, and dieldrin as adulticides for Canadian forest species of *Tabanus* and *Chrysops*. The laboratory tests showed all three insecticides to be toxic, lindane being much the fastest in action. Aerial application of 0·5 pounds of lindane per acre to plots 1 mile square with a Dakota (C-47) aircraft fitted with a rotary brush unit temporarily eliminated tabanids in open but not in dense forest. Temporary but unsatisfactory reduction was obtained with DDT at 0·25 to 2 pounds per acre. Negligible reduction was obtained with dieldrin at 0·5 pound per acre, and temporary reduction at 1 pound per acre.

" Populations were assessed on the basis of landing rates on tents of

black cloth. Tabanid activity varied widely with weather conditions, depending principally on air temperature."

Dalmat, H. T. **Cutaneous Myiasis of the Scalp due to** *Dermatobia hominis* **(Linnaeus Jr.) (Diptera: Cuterebridae).** *Amer. J. Trop. Med. & Hyg.* 1955, Mar., v. 4, No. 2, 334–5.

Hilmy, I. S. **The Cheese Skipper as Cause of a Case of Urinary Myiasis in Egypt.** *J. Egyptian Med. Ass.* 1954, v. 37, No. 8, 969–82, 2 figs. [16 refs.]

A review of the literature on myiasis due to *Piophila casei*, the common cheese maggot fly, shows that this fly has been frequently incriminated as the cause of accidental intestinal myiasis. In Egypt heavily salted cheese is very generally consumed but the larva of *P. casei* has not been reported from the human intestine in that country.

Myiasis of the urinary tract of man has never been observed in Egypt and the present case is therefore the first to be recorded. It may also be the first report of *P. casei* as a dipterous fly producing urinary myiasis.

The present account concerns a girl aged 20 living in Cairo. The presence of larvae in the urine was demonstrated and she was put on " Kaviase with methylene blue " (Laboratoires Georges Carnet, Paris). Pills were taken daily from 18th October until 2nd November 1951. As the passage of viable larvae continued the treatment was resumed in November and December 1952 until an adult fly was voided. After this no more larvae appeared in the patient's discharges and in March 1954 her urine was still free of eggs and larvae. *H. S. Leeson*

Blanton, F. S., Graham, O. H. & Keenan, C. M. **Notes on** *Culicoides furens* **(Poey) at Fort Kobbe, Canal Zone.** *Mosquito News.* 1955, Mar., v. 15, No. 1, 13–18, 1 fig. [24 refs.]

Many species of *Culicoides* have been reported from Panama but Fort Kobbe has an almost pure colony of *Culicoides furens*. One of several salt marshes near the Fort is used as a disposal area for spoil from dredging operations. Before 1950 this area was subject to tidal inundations and *Culicoides* larvae were very abundant in the flooded zones, but since then tide-gates have been installed and sea-water excluded.

In 1950, 552 locations were positive for larvae. Since then many impassable boggy areas have become dry and overgrown with a dense stand of mangroves. The combined effect of dryness, reduced salinity and increased shade has resulted in reduced numbers of larvae. Of 98 samples tested in September 1952 only one was positive and only 1 larva was found, in contrast with the former samples, many of which contained as many as 500 larvae.

Adult *Culicoides* were caught on oiled papers in horse-baited traps and then counted. Altogether in 10,829 collections, 1,212,877 specimens were caught. A graph shows the monthly averages from August 1950 to December 1953; these range from 2 in April and May 1953 to 684 in December 1950. An unaccountable increase in the *Culicoides* population began in the latter part of 1953 which was thought to be due to leaking time-gates.

Aircraft spraying of lindane and chlordane was effective but expensive;

hand spraying of dieldrin on breeding places was also successful and painting of window screens with 5 per cent. DDT in kerosene reduced the number of adults entering houses for a short time. But the authors feel that the installation of improved tide-gates will so change the ecology of the area that *Culicoides* breeding will eventually become negligible. *H. S. Leeson*

See also p. 831, Gudgel & Grauer, **Acute and Chronic Reactions to Black Fly Bites** (*Simulium* **Fly).**

Nicoli, R. M. Sur une nouvelle technique d'étude des phlébotomes (*Nematocera psychodoidea*). [**A New Technique for the Study of** *Phlebotomus*] *Bull. Soc. Path. Exot.* 1954, v. 47, No. 5, 678–80, 1 fig. on pl.

The author describes a method of mounting suitable for *Phlebotomus*; it is said to give good colour contrast and to show internal chitinous structures, such as the spermathecae, clearly defined through the transparent integument. A further advantage of the method is claimed to be the suitability of specimens for photography.

The method is briefly as follows. The specimen is cleared in hot 10 per cent. potassium hydroxide solution for an hour; depigmented by exposure to sunlight for 3 days; washed; stained for an hour in a saturated solution of pyrogallic acid in 70 per cent. alcohol at 50°C. Finally, the specimen is dehydrated for 24 hours in absolute alcohol, cleared in toluene and mounted in Canada Balsam.

The specimen can then be photographed, if desired, with fine-grain negative material, developed in a fine-grain developer [a formula is given that has proved satisfactory]. Finally, prints are made on extra-hard contrast paper.

The length of time required for the method of preparation described is considerable; to judge by the plate accompanying the text, it is questionable whether the labour is as well rewarded as the author claims.

D. M. Minter

Marx, Ruth. Über die Wirtsfindung und die Bedeutung des artspezifischen Duftstoffes bei *Cimex lectularius* Linné. [**Host-Finding and the Importance of Specific Scents in the Biology of** *Cimex lectularius*] *Ztschr. f. Parasitenk.* 1955, v. 17, No. 1, 41–72, 9 figs. [Numerous refs.]

"The butterfly's got wings of gold
The firefly wings of flame,
The bedbug's got no wings at all
But it gets there just the same."

This investigation is an attempt to find out how, or why, the bedbug "gets there". Effects of light on fed and unfed bugs of both sexes and the effects of temperature and odours from various animals were studied. Much interesting information on the biology of the bug was collected but not of direct or immediate importance in its control. *K. Mellanby*

Dias, J. A. T. S. Contribuição para o conhecimento da fauna ixodológica da Índia Portuguesa. [**Studies on the Ixodidae of Portuguese India**] *Anais Inst. Med. Trop.* Lisbon. 1954, June, v. 11, No. 2, 361–439, 28 figs. [29 refs.]

The English summary appended to the paper is as follows:—

"1—For the first time the study of the Ixodidae from Portuguese India

(formed by the territories of Goa, Damão and Diu, situated on the Malabar Coast, and at the entrance of the Cambayan Gulf) was carried out, based on twenty two batches of ticks, belonging to the following species:

Amblyomma integrum Karsch, 1879.
Boophilus (*Uroboophilus*) *australis* (Fuller, 1899).
Haemaphysalis bispinosa bispinosa Neumann, 1897.
Haemaphysalis spinigera spinigera Neumann, 1897.
Haemaphysalis parva Neumann, 1908.
Hyalomma (*Hyalomma*) *excavatum* Koch, 1844.
Hyalomma (*Hyalomma*) *detritum* Schülze, 1919.
Hyalomma (*Hyalommina*) *hussaini* Sharif, 1928.
Nosomma monstrosum (Nuttal e Warburton, 1908).
Rhipicephalus sanguineus sanguineus (Latreille, 1806).
Rhipicephalus haemaphysaloides haemaphysaloides Supino, 1897.

" 2—The adult stages of the different species and their respective biology are described, commentaries are made and hosts and geographical distribution given, when known.

" 3—The sub-genus *Hyalommina* Sharif, 1919, is taken as legitimate, although condemned by Delpy in 1949, under the allegation that its species were nothing but ' pusillum ' variations of *Hyalomma*. In our commentaries on the subject, we contradict his criterium—except in the case of *H. rhipicephaloides* (Neumann, 1901) bearing in mind certain morphological particularities, always constant, observed in the sub-genus *Hyalommina* and never observed in dwarf individuals of the former genus.

" 4—The Ixodidae list from Portuguese India is no doubt much larger than the present one, especially if we bear in mind what occurs in the Hindustan Peninsula, of similar ecological conditions, where Sharif in 1928 registered 52 species. For this reason we suggest that the subject be further and better studied in both its systematic and biological aspects, thus contributing to the better knowledge of the faunistic patrimony of this region of our Overseas Empire."

Rendiconti Istituto Superiore di Sanità. Rome. 1954. Suppl. 396 pp., numerous figs. [Numerous refs.] **1st International Symposium on the Control of Insect Vectors of Disease.** Rome: Fondazione Emanuele Paternò, Viale Regina Elena, 299. Oxford: Blackwell Scientific Publications Ltd., 24–25, Broad Street. [L.5000; 57s. 6d.]

The papers here published were considered at an international symposium which took place in Rome in November 1953. They cover a field more restricted than indicated by the title of the book, dealing exclusively with insecticides, and mainly with their use in control of insects of medical importance in the Mediterranean and sub-tropical rather than tropical areas. There are some 20 papers: they form a valuable group and give a compact and clear account of the subject as it was nearly two years ago. Some are from men who have practical experience in the field, others deal with laboratory studies, for instance in the physiology and genetics of resistance to insecticides.

One cannot give a detailed account of the volume, but might call attention to a group of papers on DDT-resistance in *Musca* and in other insects. We think that there is a tendency to use the word " resistance " in several senses which may be confusing. In general, it is used here, as elsewhere, for the increased or acquired resistance to modern synthetic insecticides; there are also references to what is sometimes called " behaviouristic

resistance" by which it is meant that some species of insect will change their habits, tending for instance to rest more out of doors, if the insides of houses are treated with an insecticide. There are also references here and there to "natural resistance"; this is an unfortunate, confusing phrase, though one may legitimately say that man has more natural resistance to cyanides than dog.

In the present volume several of the papers (for instance that by Professor G. G. Mer from Israel) emphasize once again the difficulty of controlling the house-fly in areas where it has become resistant, not only to one but to several synthetic insecticides. One author (S. W. Simmons from Atlanta, Georgia) gives a valuable account of the development of resistance among many types of insects to a great variety of materials, including substances so diverse as hydrocyanic acid, lead arsenate and lime sulphur. He then passes to the modern period and here, as it seems to the reviewer, he is too willing to quote unconvincing evidence. For instance, a large table shows the reported geographical distribution of insecticide resistance among nearly a score of species of mosquitoes, a number of other Diptera and several fleas, ticks and so forth. If one takes the trouble to check the references quoted in the table, it appears that some of it is based on "personal communications". We take the view that the only work on insecticides which should be reported is based on well established facts. Scientific workers on insecticides should adopt a critical standard using measurement of doses and of mortality, as men do in other branches of pharmacology: we should be happy to see the anecdotal side of the matter excluded.

A number of other interesting papers must be studied in the original. There are two on the genetical side of the development of resistance in house-flies, and a group by several authors who describe their experiences and the difficulties they encountered in using insecticides for purposes of public health in the Mediterranean countries. Reference must also be made to the contribution of A. W. A. Brown on the chemical control of mosquitoes in Canada.

The papers are produced in English or French with summaries in these languages and Italian and German. The printing and the reproduction of the photographs are adequate. The price is high, for a paper-bound volume.

P. A. Buxton

I. Soap. New York. 1955 (Blue Book), 249–50, 267. **The Peet-Grady Method. Official Method of the Chemical Specialties Manufacturers Association for evaluating Liquid Household Insecticides, Latest Revision.**

II. Soap. New York. 1955 (Blue Book), 251–2. **Aerosol Insecticides Storage Test. Tentative Official Method of the Chemical Specialties Manufacturers Association for Storage of Aerosol Insecticides.**

III. Soap. New York. 1955 (Blue Book), 253–4, 266–7. [10 refs.] **Aerosol Test Method for Flying Insects. Official Method of the Chemical Specialties Manufacturers Association for assaying Aerosols for Flying Insects.**

IV. Soap. New York. 1955 (Blue Book), 255–6. **Cockroach Spray Method. Official Method of the Chemical Specialties Manufacturers Association for evaluating Cockroach Sprays.**

II. A description is given of certain proposals for the storage testing of aerosol containers. In such work it is necessary that there should be

sufficient samples to replace any containers that fail during the test; that examinations be conducted according to standardized procedures and at regular intervals and that the tests be conducted by persons familiar with the problem and who are qualified to evaluate the condition of the containers, the valve components and the product.

In addition, before the tests commence, all pertinent background information should be assembled.

There are two types of storage test, known as " live " and " dead ". In the first the valves are actuated and the determinations are made at relatively frequent intervals. In the second, the conditions simulate those found in warehouses and the object is to ascertain the " shelf-life " of the complete package.

The details of these methods are described as well as certain safety precautions. A typical test is presented in tabular form.

III. The aerosol test method here presented is based on experiences of previous series of cooperative tests and in so far as practical, follows the official Peet-Grady test procedure. This technique for testing aerosols should be regarded as a practical test method designed for the comparison of formulations in the dispensers in which they will be employed by the consumer. It is restricted at present to use against house-flies though with modifications in dosage it would, it is felt, be satisfactory for other flying insects.

The method is given in detail under paragraph headings including the reference insecticide, the dispenser, the test insect, the cages, the rearing room, rearing and handling, testing and assembling data. Those interested need to consult the original.

IV. Entomologists investigating insecticides should also consult this paper for details of a cockroach spray method which has been developed through cooperative tests between various laboratories in the U.S.A. and is thought to offer a satisfactory means of determining the relative efficiency of contact insecticides in oils as cockroach sprays. *H. S. Leeson*

HALLER, H. L. **Common Names of Insecticides for Use in the Journal of Economic Entomology.** *J. Econom. Entom.* 1955, Feb., v. 48, No. 1, 112–15.

The following is taken from the author's summary:—

" This list supersedes the one approved at the 1951 meeting of the Association of Economic Entomologists and published in the February 1952 issue of the JOURNAL, Vol. 45 (1): 165–6."

REPORTS AND SURVEYS

WALTERS, J. H. **Uncommon Endemic Diseases of the Persian Gulf Area.** *Trans. Roy. Soc. Trop. Med. & Hyg.* 1954, Sept., v. 48, No. 5, 385–94, 10 figs. on 6 pls. & 1 map. [14 refs.]

Following the development of its oilfield, thousands of people have come to Kuwait within recent years and at the hospital there the diseases encountered are thus a fair sample of those prevalent in the surrounding region. Some of these diseases are commented upon in this paper

Four cases of *Schistosoma mansoni* infection are described. In all there was hepatomegaly, anaemia, low serum albumin and raised serum globulin, and the diagnosis was proved by demonstrating the typical ova. In 3 cases the histology of the liver was studied and changes found included chronic inflammatory reaction with fibrosis in the portal tracts, diffuse fibrosis, and foci of parenchymal necrosis with areas of regeneration. One patient had an intense localized schistosomal ileitis, leading to perforation of the ileum and death from acute peritonitis. The treatments used included administration of a high protein diet to combat nutritional defects together with courses of Stibophen or Miracil, or both.

Two cases of visceral leishmaniasis in young children and 3 of anaemia associated with the sickle-cell anomaly are described. Of the latter the first patient suffered from sickle-cell anaemia due to homozygous inheritance of the sickle-cell trait; in the second, the father had thalassaemia minor while the mother carried the sickle-cell trait and a chronic haemolytic anaemia resulted, the peripheral blood picture simulating that of both Mediterranean anaemia and sickle-cell disease. In the third, there was a toxic depression of the bone-marrow induced by anthracene drugs, together with heterozygous inheritance of the sickle-cell trait, yet with a proportion of foetal haemoglobin present. This suggested the combination of the sickle-cell gene with that of either thalassaemia or haemoglobin C disease. These cases confirm the previously reported fact that the sickle-cell gene is not restricted to Negroes but may appear among those of the Arab race.

Finally, attention is drawn to the high incidence of endemic fluorosis in countries bordering the Persian Gulf. Among those born in Kuwait, teeth devoid of mottling are exceptional, and the local water contains 2–2·4 parts per million of fluorine. Advanced skeletal fluorosis has also been encountered. A detailed account is given of two cases and there are photographs of radiograms showing the bony changes. Paraesthesia without objective sensory impairment, and generalized spasticity, were complained of in 4 out of 8 patients with fluorosis. Neurological changes previously described in fluorosis have been attributed to compression of the spinal cord by posterior protrusion of osteophytes into the spinal canal [see Shortt *et al.*, *Bull. Hyg.*, 1938, v. 13, 176]. In the cases here studied, however, the changes present suggested that the syndrome may result from a generalized toxic degeneration of sensory and pyramidal nerve cells, for spasticity was present in muscles—such as the temporalis—which were too high to be affected by lesions in the spinal cord or spinal roots. *A. W. Woodruff*

Coonoor. **The Pasteur Institute of Southern India, Coonoor. Section A. Annual Report of the Director 1953** [Veeraraghavan, N.]. 26 pp., 2 charts. 1955. Madras: Diocesan Press.

This Report follows the lines of its predecessors [this *Bulletin*, 1954, v. 51, 660]. The usual full statistical account is given of antirabic treatment. There were 104 Europeans fully treated with no deaths, and 10,242 Asians with 6 deaths. It is noted that 380,275 cc. of vaccine were issued for the treatment of animals and 2,686 animals were actually treated during the year.

General laboratory examinations amounted to 5,490 and these are set out in a table. Nine other tables are devoted to statistics on rabies.

The Scientific Report for 1954 is included and papers from it have been abstracted separately. *H. J. O'D. Burke-Gaffney*

Indian Council of Med. Res. **The Nutrition Research Laboratories, Coonoor, South India** [Patwardhan, V. N., Director]. Annual Report for 1953–54. pp. ii + 27, 3 figs. on pl. 1954.

Most of the studies discussed in this interesting report of the work of the Nutrition Research Laboratories at Coonoor have been the subject of papers in the medical literature, many of which have been abstracted in this *Bulletin*.

The first section deals with experiments on the stability of vitamin A during domestic cooking and on the mode of action of vitamin D. This is followed by a section dealing with proteins and in particular with the nutritive value of duck egg-white and with protein metabolism.

There is then a short tabulated report of the findings in the Nutrition Clinic during the year. Of 3,946 persons attending, 184 showed evidence of nutritional disorders, most of the in-patients presenting signs of nutritional oedema. There is then a clinical section, dealing at some length with studies on body composition and changes in severe malnutrition, with emphasis on the nutritional oedema syndrome (kwashiorkor) [this *Bulletin*, 1954, v. 51, 715 *ter*].

The section on pathology is largely devoted to studies on liver injury, to which the staff has devoted special attention [*ibid.*, 717] and on metabolic inter-relationships of haemopoietic factors. The last section summarizes work on studies on child growth.

The considerable amount of research work done and its wide range is reflected in the list of publications and of papers presented at meetings by members of the staff; the former amounted to 18 and the latter to 12.

H. J. O'D. Burke-Gaffney

Lemos, F. C. Contribuição à história do Instituto Bacteriológico 1892–1940. [**History of the Bacteriological Institute, São Paulo, 1892–1940**] *Rev. Inst. Adolfo Lutz.* São Paulo. 1954, v. 14, Special No., 161 pp., 5 figs. [Numerous refs.]

BOOK REVIEWS

London School of Hygiene and Tropical Medicine. Memoir No. 10. **The Natural History of Tsetse Flies. An Account of the Biology of the Genus *Glossina* (Diptera)** [Buxton, Patrick A. (C.M.G., F.R.S.)]. pp. xviii + 816, 165 figs. & 47 pls. 1955. London: H. K. Lewis & Co., Ltd., 136, Gower Street, W.C.1. £4 4s. 0d.]

A comparison of this impressive volume with the monograph on the tsetse flies by Newstead, Evans and Potts [this *Bulletin*, 1925, v. 22, 80] gives some indication of the advances that have been made in the past 30 years. They are advances not only in factual knowledge and in techniques of study and of control, but even more, developments in outlook which this increased knowledge has made possible. In the tsetse problem, as in the *Anopheles* problem, a number of different species with differing habits are to be found throughout a wide range of localities, each with its characteristic climate, vegetation and fauna, and with a characteristic mode

of life among its human inhabitants. The tsetse problem is therefore always a local problem. This is reflected in the literature by the existence of innumerable papers which describe local conditions at great length and in great detail. In such a subject, general principles are hard to come by.

The outstanding merit of Professor Buxton's book is that although the local variations are fully recognized (and that accounts for the unavoidable length of the book), yet there is a guiding thread which holds the story together. That thread is autecology based on physiology. Even with the present limitations of knowledge, this provides a solid foundation. In many chapters, after surveying the topic region by region, or species by species, the author is able to enunciate the general principles which summarize existing knowledge. One is struck by the extent to which laboratory work on the tsetse fly has provided a basis for understanding its ecology. No amount of laboratory work is going to solve the tsetse problem, but as a source of new ideas and generalizations it has evidently paid good dividends.

As in all applied entomology the central problem is the regulation of populations. Here we are singularly ignorant. The author is just as much in the thrall of the dogma that populations must be regulated by density-dependent factors as are most other workers in population ecology. And since no density-dependent factors are known, therefore population regulation in the tsetse is a mystery. But the practical tsetse entomologist will probably not allow himself to be discouraged by such theoretical considerations—he will continue to reduce tsetse populations by modifying the microclimate.

The general arrangement and writing of this book are wholly satisfactory. The arrangement is by topics such as " metabolism ", " sources of food ", " tsetse and climate ", " tsetse and trypanosomes ", etc., and within these general chapters specific and geographical differences are fully recognized. Apart from the text, special mention must be made of the illustrations, particularly the numerous maps. These are the work of H. S. Leeson. They combine an artistic quality with great clarity and an agreeably uniform style; they add much to the value of the book. The volume has a splendid index and a well chosen series of photographs, nearly two hundred in number. It is hardly necessary to say that *The Natural History of Tsetse Flies* will be the stand-by of all tsetse workers for many years to come.

V. B. Wigglesworth

Geigy, R. & Herbig, A. **Erreger und Überträger tropischer Krankheiten.** [Agents and Vectors of Tropical Diseases] *Acta Tropica*. Basle. 1955, Suppl. 6, pp. xxiv + 472, numerous figs. [Bibliography.] Basle: Verlag für Recht und Gesellschaft AG., Bundesstrasse 15. [Sw.fr. 80.–.]

The present book, as is made clear in the Preface by Professor Mooser of Zurich, is by no means a handbook of tropical medicine, but rather a student's textbook combining medical entomology and protozoology, and developed, we think, from a course given by the two authors in the Tropical Institute at Basle, Switzerland. It is a most difficult matter to arrange a book or course in this subject for one has to decide whether the general classification shall be by taxonomic units, such as Diptera, Culicidae and Sporozoa, or whether to arrange the subject under medical headings, malaria, etc. If one chooses the former, is one to divide relapsing fever and put part of it with the lice and part with the ticks? Or where do the trypanosomes come in relation to *Glossina*, *Triatoma*, fleas and so forth? Moreover, if most of the chapters deal with diseases, what is to be done

with insects which themselves produce symptoms, *e.g.*, fly larvae causing myiasis, and the chigger flea? And where is one to deal with the reactions of the mammalian host to Protozoa or to the bites of insects?

The present authors provide a group of general chapters occupying 10 per cent. of the whole book and follow this with a number of special chapters. In the general part they discuss parasitism and the transmission of micro-organisms by arthropods, and then give a brief account of insect-transmitted tropical diseases of man and domestic animals. They follow this with a general account of the insects, their morphology, anatomy, reproduction and behaviour. There is also a tabulation of the names of the insects under families and genera, with the names of the associated diseases. The description of the characters of the groups appears in different places in the text, in close association with diseases: *e.g.*, for Simuliidae, see under Onchocerciasis.

In the "special" part of the book the main basis of classification is by disease; putting the most important one first, the authors lead off with "Mosquitoes: Malaria". They cover the subject very well; though their classification is partly by protozoology (*i.e.*, by species of *Plasmodium*) and partly in terms of the insect, but the whole subject becomes clear. We feel that they are less successful with the mosquito-transmitted viruses. There is a brief account of the difference between the Anopheline and Culicine mosquitoes, but there is one page only on dengue and one on yellow fever. The latter seems inadequate for a subject in which so much new fascinating work might be presented, and in which important developments in epidemiology are now taking place. The reader would hardly suspect the important difference between jungle and urban yellow fever; he is not told about the rôle of monkeys or other mammalia; no mention of the other mosquito-borne viruses is made. Modern developments with insecticides are not discussed.

After dealing with the principal biting insects and the infections and diseases transmitted first by insects and then by ticks and mites, the authors give a section to those arthropods which themselves produce symptoms. The book is then closed by a number of notes on laboratory techniques, including preparation and staining of blood films, and on such matters as culture of protozoa. Entomological and certain other techniques appear in the course of the book: for instance, after Leishmaniasis, there are some papers on collecting adult and larval *Phlebotomus*, and methods of maintaining them alive, and of making a diagnosis of the disease: there is a similar section, ten pages with illustrations, on the entomological and protozoological techniques associated with malaria.

It must have been a most difficult matter to write a book of moderate length and to decide what had to be included or not, a matter on which every writer would hold different views. For ourselves we feel that in presenting medical entomology one must demonstrate its close relationship to epidemiology, that is to say, medical entomology appears to be developing rather in the direction of medicine and away from the rest of entomology. This book is perhaps not very successful on that side.

There are a number of exceedingly good plates of breeding places, many of them taken by Professor Geigy in East Africa. The black-and-white figures are also original and excellent, showing in the clearest way such things as the cycle of a parasite both in the mammal and the insect, or the life history of one of the biting insects. A large amount of information is shown well and clearly in tables which form an important original contribution. Legends of tables, plates and figures are in German, French and English.

P. A. Buxton

TROWELL, H. C. [O.B.E., M.D., F.R.C.P.]. **Mitchell's Anatomy and Physiology, and Causes of Disease.** For the Use of Students in Tropical and Sub-Tropical Countries. 3rd Edition. pp. xvi + 244, 2 diagrams & 87 figs. 1955. London: Baillière, Tindall & Cox Ltd., 7 & 8, Henrietta Street, W.C.2. [7s. 6d.]

This very readable little book admirably succeeds in its purpose of providing a textbook suitable for African nurses and medical assistants. It is not only a mine of information; it also introduces the subjects of anatomy and physiology and the cause of diseases in an easily understood and attractive way, illustrations being drawn from the author's long experience among the people for whom he is writing. The derivations of technical terms are explained by simple interesting comments which students who lack a classical education will welcome.

The book consists of Part 1: Anatomy and Physiology and Part 2: Causes of Disease. The order in Part 1 is interesting. After an introductory chapter, the nervous system is boldly tackled, then the skeleton and connective tissue and muscular system. In this way the dry bones seem readily to live. Further chapters are devoted to the blood and lymph, respiration, food and metabolism, excretion, body temperature and reproduction. In Part 2 chapters are devoted to viruses and bacteria, protozoa, animal parasites and nutritional and other problems. The final section is designed to leave the student with an enquiring mind and the realization that all is not yet explained.

A few minor criticisms may be made. The spinal cord is said to extend the whole length of the spinal column. The sensations of taste and smell are explained but a word on the appreciation of flavour might be added. The salivary gland in fig. 38 appears to be too posterior. Thrombosis in varicose veins as the introduction to the danger of embolism is misleading. The phrase " curious twins " is somewhat ambiguous and this, together with the references to the lack of convolutions in the brains of primitive races, without stating where primitive races are to be found, is, perhaps, unwise, particularly for readers in Africa.

This book can be confidently recommended for nurses and medical assistants in the tropics and could be profitably read also by medical students and their teachers. *Frederick J. Wright*

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